THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY).

FOR THE YEAR ENDING 31ST OF MARCH 1874.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT GAZETTE PRESS.

1875.

630
M183

8466

CONTENTS.

	Paras.
GENERAL—	
Weather ...	1 to 4
Tours ...	5
Office-work ...	6 to 9
Agricultural Apprentices on the Sydapet Farms ...	10 to 16
Improvements on the Sydapet Estate ...	17
The Wudder Settlement on the Sydapet Estate ...	18 to 24
Snakes and other vermin killed on the Sydapet Estate ...	25 to 28
Madras Agricultural Exhibition ...	29
The absence of a local demand for agricultural produce of a superior kind ...	30 to 35
Fish preservation ...	36 to 38
The field laborer ...	39 to 43
Live fences ...	44 to 45
Deep and shallow cultivation ...	46 to 50
Loss by thick sowing and by using bad seed ...	51 to 55
SYDAPET EXPERIMENTAL FARM—	
Cattle ...	56 to 65
Sheep ...	66 to 70
Pigs ...	71 to 73
Cotton ...	74 to 86
Maize and cotton ...	87 to 93
Burmese paddy ...	94
Shamay... ...	95 to 98
Paddy fodder ...	99 to 101
Indigenous grasses ...	102 to 106
Field vegetable crops ...	107
Fruit and fuel plantations ...	108 to 109
Results of inquiries in other countries for crops suited for field cultivation in the Madras Presidency ...	110 to 112
Ground-nut cake ...	113 to 117
Subsoil draining ...	118 to 126
Double mhote ...	127
Bullock gears ...	128
Straw-burning engine ...	129
SYDAPET MODEL FARM ...	130 to 141
IMPLEMENT WORKSHOPS ...	142 to 147
ESTABLISHMENT ...	148

APPENDIX.

1. Rainfall of the year.
2. Government Farm's Expenditure.
3. Valuation of Live and Dead Stock belonging to the Experimental Farm.
4. Implements, Carts, Machines, &c., belonging to the Experimental Farm.
5. Do. do. do. to the Model Farm.
6. Do. do. do. to the Implement Workshops.
7. Catalogue of Books added to the Library.

THE ANNUAL REPORT OF THE SUPERINTENDENT OF GOVERNMENT FARMS, FOR THE YEAR ENDING 31ST OF MARCH 1874.

GENERAL.

1. *Weather.*—The total rainfall of the past year was 48·07 inches, or only about half the amount that fell in the previous year. Rain fell on sixty-nine days ; the total amount collected approximated very closely to the average of the previous ten years, but its fall was unseasonable.

2. In April rain fell on three days, during which 2·38 inches were registered, giving an average of 0·79 inches for each wet day ; there was no rain whatever in May, so that the little good that was done by the fall in the previous month was negatived. In June the quantity registered was 1·68 inches ; but, as it fell on six days, the average for each wet day was only 0·28 of an inch, a fall too light to be of any benefit during the scorching heat that characterises that month. The fall in July was even lighter ; though rain fell on nine days, the total quantity registered was only 1·50 inches, giving an average of 0·17 of an inch for each wet day. In August the fall was somewhat more favorable, though still below the average ; in this month rain fell on seven days, and the total fall was 3·16 inches, or 0·45 of an inch for each wet day. Thus in the three months—June, July, and August—though rain fell on twenty-two days, the total fall only amounted to 6·34 inches. The average of the previous ten years for these three months was 12·56 inches precipitated on thirty-one days, so that during this quarter, which is the period of the year in which cumboo, gingelly, and other hot weather crops are grown, the rainfall was just about half the quantity that we usually get, and this is generally but just sufficient to meet the wants of the crops then cultivated. The result of this unfavorable season on the Sydapet Farms was that the hot-weather crops had to be resown several times, and the sowings, which were at length successful, being from a month to six weeks behind time, the harvest was proportionally delayed, and the consequence of this was that the land on which these crops grew, could not be cleaned and prepared in time for the regular cold-weather crops, which in their turn were delayed. In September, which is the harvest month for hot-weather crops, the rainfall was unusually heavy ; though there were only seven days in this month on which there was rain, the total quantity collected was 7·24 inches, or a little more than one inch per wet day. In October rain fell on eighteen days, and the total fall was 12·30 inches ; throughout this month rain fell in gentle showers, the average for each wet day was 0·68 of an inch. In November the fall was unusually light, being only about half the average fall ; in this month rain fell on fourteen days, and the quantity registered was 8·91 inches ; the whole of this fell in the latter half of the month, there was no rain whatever until the 12th. The rainfall in December was excessively heavy, being nearly twice as great as the average fall ; though there were only five wet days, the fall was 10·90 inches, or 2·18 inches for each wet day. I would particularly invite attention to the rainfall registrations of this month ; it will be at once observed how delusive monthly totals are. I have said that the rainfall of this month was nearly twice as great as the average, yet our crops actually suffered severely from drought in December, for after the 4th of the month there was only one day on which rain fell, and this only amounted to half an inch ; this drought was especially severe in its effects, coming as it did so closely after heavy rain, which had caused an excessive rank growth in the crops and rendered them particularly liable to injury, when the drought suddenly checked this rapid growth. During January, February, and

March, there was no rain whatever, and many of the crops sown in November were rendered useless, excepting for providing fodder.

3. The following table shows the amount of rain that was registered during each month, and the number of days in each month on which rain fell, compared with the average monthly registrations of a similar kind for the preceding ten years :—

—	1873-74.		Average of the previous 10 years.	
	Inches.	Wet Days.	Inches.	Wet Days.
April	2·38	3	0·55	1·1
May	...	...	0·85	1·4
June	1·68	6	2·73	7·8
July	1·50	9	4·52	11·2
August	3·16	7	5 31	12·4
September	7·24	7	3·83	9·4
October...	12·30	18	8·67	10·9
November	8·91	14	13·66	14·0
December	10·90	5	5·64	6·3
January	...	...	1·08	1·4
February	...	...	0·91	0·9
March	...	...	0·08	0·4
Total ...	48·07	69	47·83	77·2

4. The following is a statement for the same period, made out in weekly totals, which I think exhibits the rainfall of the year in a much more satisfactory way than the method usually adopted :—

—	1873-74.		Average of the previous 10 years.		—	1873-74.		Average of the previous 10 years.	
	Inches.	WetDays.	Inches.	WetDays		Inches.	WetDays.	Inches.	WetDays.
1st Week...	2·20	2	...	...	28th Week...	4·22	6	·38	1·1
2nd do. ...	·18	1	·01	·1	29th do. ...	1·55	4	4·81	4·0
3rd do. ...	...	...	·19	·3	30th do. ...	1 41	2	1·75	3·1
4th do. ...	...	...	·35	·7	31st do. ...	1·08	1	1·74	2·4
5th do. ...	...	...	·76	·4	32nd do. ...	...	...	2·27	3·1
6th do. ...	...	...	·01	·3	33rd do. ...	2·24	5	2·15	2·9
7th do. ...	...	...	·05	·3	34th do. ...	2·80	3	4·00	4·0
8th do. ...	...	...	·03	·3	35th do. ...	10·02	7	4·60	3·4
9th do. ...	...	...	·13	·3	36th do. ...	4·25	3	4·16	2·6
10th do. ...	·48	2	·64	1·0	37th do. ...	...	...	·62	1·3
11th do. ...	·66	2	1·19	2·5	38th do. ...	·50	1	·30	·6
12th do. ...	·17	1	·32	1·8	39th do. ...	...	...	·19	1·2
13th do. ...	·37	1	·45	2·3	40th do. ...	...	...	·03	·4
14th do. ..	·56	3	·25	1·6	41st do. ...	...	...	·01	·1
15th do. ...	·04	1	1 54	2·9	42nd do. ...	...	...	·57	·6
16th do. ...	·15	2	·99	3·0	43rd do. ...	...	...	·47	·2
17th do. ...	·75	3	1·07	2·6	44th do. ...	...	...	...	....
18th do. ...	·53	2	1·25	2·6	45th do. ...	...	...	70	·6
19th do. ...	...	...	1·70	3·4	46th do. ...	...	...	·02	·1
20th do. ...	...	...	·54	3·0	47th do. ...	...	...	·12	1
21st do. ...	2·46	4	1·17	2·0	48th do. ...	...	...	·07	·1
22nd do. ...	1·12	2	1·27	2·7	49th do. ...	...	...	·08	·4
23rd do. ...	·23	1	·77	2·7	50th do. ...	...	...	...	...
24th do. ...	...	...	·92	2·3	51st do. ...	...	...	...	...
25th do. ...	2·50	3	1·40	2·4	52nd do. ...	...	...	...	...
26th do. ...	3·56	2	·64	1·5					
27th do. ...	4·04	5	1·15	1·9	Total ...	48·07	69	47·83	77·2

5. *Tours.*—No tours were undertaken by me during the past year, as I had found by experience that I could not, in a satisfactory way, when on tour, perform the many important duties which I am now called upon to undertake, unless aided by a really competent Assistant at my head-quarters; while my duties, as Secretary to the Exhibition, required my presence in Madras during the cold season.

6. *Office-work.*—My office-work still continues to increase; it was exceedingly heavy during the past year; to some extent this was caused by the Agricultural Exhibition in February last, to which I was Secretary; in connection with this I had to conduct a very large amount of correspondence, and as all the money-transactions relating to this undertaking were conducted in my office, a great amount of additional labor was thrown upon my establishment, and this, in connection with the fact that the office-work was already much behind, has placed me rather in a difficulty with regard to the performance of current work; but with the aid of the Assistants recently appointed, I hope, before the expiration of another year, to have worked off all arrears.

7. The large increase in my office-work is not, I think, any cause for regret, provided I am furnished with the means to enable me to keep pace with it; but it is a serious labor and a cause of much anxiety to me, the effort to carry on my current work with such an accumulation of arrears demanding more or less urgently my attention.

8. It is, I consider, greatly to be desired that, as far as possible, my office should be the medium through which agricultural information relating to the Presidency should be collected and disseminated; to some extent this is already recognised as its legitimate work, and I have done all I could to increase its usefulness in this direction by encouraging correspondence with persons, in all parts of the Presidency, interested in agriculture, who may be able and willing to afford information, or who may be anxious to benefit by our experience.

9. The following questions selected from those put in the demi-official letters received by me during the last year will convey a general idea regarding the subjects on which I am consulted. The questions included in this list are but a small number of those that have been answered during the year :—

District, Presidency, or Province from which the Questions came.	General Nature of Question.
Cochin	Requesting full instructions regarding the cultivation of guinea grass.
Madras	Asking for directions regarding the method of working European ploughs and cultivators.
Cochin	Asking for information about the culture of fodder crops.
Madras	Asking for information about the ground-nut oil cake, how used, quantity given daily to working cattle, &c.
Bellary	Asking advice regarding shrubs best suited for forming live fences in the Bellary District.
Ganjam	Asking for information regarding the culture of Carolina paddy and New Orleans cotton.
North Arcot...	Asking for advice regarding laying down land under pasture and the variety of grass best suited.
Wynaad	Asking for advice regarding fodder crops best suited for Wynaad and their general cultivation.
Rangoon	Asking for information about the cultivation of potatoes and the manure to be employed; also desiring to be informed the breed of sheep best suited for the higher lands in Burmah.
Madras	Asking for opinion regarding the probable success of a European butchery in Madras.
Madras	Asking for advice regarding the use of ground-nut cake in feeding horses.
Mysore	Asking for information and advice regarding turn wrest ploughs.
Punjab	Asking for advice regarding the use of ground-nut cake in feeding horses.

District, Presidency, or Province from which the Question came.	General Nature of Question.
Trichinopoly	Asking advice regarding the probable growth of grass and cocoanut trees under sewage irrigation.
Wynaad	Asking information regarding the most suitable manure for land under coffee.
Mysore	Asking for advice regarding the construction of cattle-sheds.
Madras	Asking for advice regarding the construction of a sheep-pen for fattening sheep.
Ganjam	Asking for detailed information regarding ploughs best suited for use in native agriculture.
North Arcot	Asking for advice regarding the construction of cattle-sheds.
Mysore	Asking how adulteration can be detected in a sample of ground-nut cake.
Bombay	Asking to be informed the steps to be taken to gain a knowledge of the practices of improved agriculture.
Madras	Asking information regarding the feeding qualities of ground-nut oil cake.
North-West Provinces ...	Asking for advice regarding the preparation of paddy hay and its value for horses.
Madras	Asking for opinion regarding the supposed tendency of ground-nut oil cake to excite unduly the urinary organs of animals fed on it.
Madras	Asking for instructions regarding the cultivation of Carolina paddy.
Tanjore	Opinion asked regarding purity of a sample of ground-nut oil cake and whether fit for use in feeding horses.
Travancore	Asking where a pupil could be trained in a knowledge of agricultural chemistry, and asking for suggestion that would assist a beginner in analytical work.
Godavery District	Asking for information as to the probable effects of nightsoil used as a manure for trees, and asking opinion regarding general value of nightsoil as an agricultural manure.
Malabar	Inquiring the commercial value of groundnut oil, and asking the uses to which it can be applied.
Ganjam	Asking to be informed how to select a sample of soil for analysis? how to drain the subsoil of land? and how to improve indigenous breeds of cattle?
Calcutta	Asking for full details of cultivation of the ground-nut, and description of climate and soil best adapted for its healthy growth.
Kistna District	Asking for advice regarding the study of agriculture, and the sciences bearing thereon.
Wynaad	Asking advice regarding the treatment of cattle suffering from rinderpest.
Trichinopoly	Requesting opinion of the feeding value of gingelly oil cake for milch cattle.
Madras	Asking advice regarding treatment of sick poultry.
Madras	Inquiring regarding the value of Indian corn as food for horses, and the preparation it should undergo before being given to them.
Coimbatore District ...	Asking to be advised regarding the selection of a plough for use by ryots.
Wynaad	Asking opinion regarding leaf disease on coffee trees, probable cause, treatment to be followed, &c.
Tinnevelly	Asking for advice regarding the utilization of waste lands by planting, &c.
Tanjore	Asking for advice regarding the establishment of a Model Farm to be managed by a private association composed of native gentlemen.
North-West Provinces ...	Asking for advice regarding the plough best suited for introduction amongst native cultivators.

10. *Agricultural Apprentices.*—In my last annual report, and in a special report, I directed attention to the very unsatisfactory conditions under which the District Farm Apprentices are placed for gaining a knowledge of agriculture; it is, therefore, unnecessary again to go over

the same ground here. The following "examination results" will convey a general idea of the kind of information with which these Apprentices are expected to become acquainted :—

—	Full Marks.	A.	B.	C.	D.	E.
District Farm Apprentices' Examination held on the 11th of June 1873.						
Paper Examination.						
1.—The pay of a cooly is 5 Rs. a month of 30 days; he is absent 8 days; what pay is due to him?	10	10	10	10	10	10
2.—A heap of manure measures 8 yards in length, 4 yards in width, and 7 feet in depth; what are its cubical contents?	10	10	5	10	10	...
3.—If a plough travels at the rate of 1½ miles per hour, turning over a furrow slice 9 inches wide, what area will it plough in a day of 8 hours, deducting 20 per cent. for turnings at the headlands?	10	...	5	...	...	...
4.—On 485 square yards of land I broadcast 50 lbs. of castor oil-cake manure; how many pounds will be required to manure an acre of land at the same rate?	10	10	...	2	10	10
Vivâ Voce Examination.						
1.—How many coolies will hoe one acre of land in a day of 9 hours, the land being under cotton moderately free and not foul with weeds?	5	5	1	1	2	2
2.—How many loads of earth from a heap should one man fill and cart to a distance of 1 mile in a day of 8 hours?	5	2	5	...	4	3
3.—At what rate per hour do the farm-cattle travel when ploughing?	5	4	2	2	5	...
4.—What medical treatment did the cattle suffering from foot-and-mouth disease undergo? ...	5	4	5	2	4	...
5.—What has been done during the last few days in field 25?	5	5	5	4	5	4
6.—What was the cost of cutting the drains in No. 16 field?	5	...	2	3	4	2
7.—About how many pounds per acre did the crop of gram fodder in No. 4 field yield?	5	...	...	...	...	...
8.—How many pounds of cotton will a cooly collect in a day of 9 hours if at the time there is about 60 lbs. per acre on the trees?	5	...	5	2	2	...
9.—About how many gallons of water does the lift in well No. 13 raise in a day of 8 hours? ...	5	...	...	...	...	...
10.—What price per cubic yard would you give for excavating earth in No. 14 field (in the present condition of the soil) and conveying it to a distance of 10 yards?	5	1	2	4	5	4
11.—How many pounds of seed cotton did the cotton gin clean during an ordinary working day?	5	...	2	2	2	1
12.—What quantity and description of foods are given to the working cattle, feeding cattle, and sheep?	5	2	2	4	4	2
Total ...	100	53	51	46	67	38

11. It will be noticed that the majority of the questions are framed to test whether the apprentices take an intelligent interest in the work of the farm, as the training, such as it is, to which they are subjected is exclusively field training. The result of this examination is fairly satisfactory ; it was quite impossible that the youths could have prepared themselves specially for it, as the examinations are not held at stated times, no previous notice was given of the intention to hold the examination, and the questions put were framed in the room while the examination was proceeding.

12. Though, making due allowance for the circumstances under which they were placed, these apprentices have done fairly satisfactory, they have made but very little progress towards qualifying themselves to hold District Farm Superintendentships ; however they are not to be blamed on this account, it was decidedly a mistake to suppose that Hindu youths, without any knowledge whatever of agriculture or of kindred subjects, would in the space of three years by mere field employment on the Sydapet Farm, become qualified to hold the Superintendentships of District Farms. Such a training, as I have often pointed out, should qualify them to manage small farms of their own, situated in localities similarly circumstanced to the Sydapet Farms, and it should qualify them for employment as Overseers under efficient superintendence ; but it could not, in reason, be expected to do more than this. Under a good system of theoretical and practical training in the lecture room and the field, there would be no difficulty whatever in training educated native youths thoroughly in agriculture.

13. It has been contended that, because in England and Scotland farm bailiffs undergo no special training, that it is therefore unnecessary in India to place under special training youths who intend only becoming farm overseers ; but persons who view the matter in this light forget the important difference in the early training, habits and circumstances of the men who, in Britain, become farm bailiffs, and of the men who in India would become farm overseers.

14. In Britain the embryo bailiff passes through something like the following stages of employment before he is appointed a bailiff :—On leaving the village school, say at 12 or 13, the youth becomes a ploughboy, and is employed in general farm work until he is, say, 18, when he becomes a waggoner or ploughman ; a year or two later he perhaps is made the foreman ploughman ; his next step in promotion is his appointment as yardman, next his appointment to be foreman in charge of women and field workers ; and, finally, when perhaps nearly 30 years old, he is appointed bailiff. While passing through these various stages in training the man is employed at all kinds of agricultural work ; he meets with but little that is opposed to his early training or prejudices ; he hears good farming favorably spoken of on all sides, and he adopts naturally the improving agriculture he sees generally practiced.

15. How different are the circumstances under which a youth is placed in this country who wishes to become a farm overseer where rational agriculture is practiced. Probably, at 18 he leaves school, when perhaps he possesses a fair knowledge of the English language ; he goes, let me say, to Sydapet to undergo training, where he finds everything different to what he has been accustomed ; he finds implements and machinery in use the names of which he even does not know ; he sees crops growing of which he had no previous knowledge ; he sees manures applied which he never heard of before ; he sees field operations performed when soil and season suit, with a perfect disregard to the opinions of the astrologers of the locality, in respect to "lucky" and "unlucky" days, &c. ; he sees animals purposely fed for slaughter to provide human food, a practice which he at first, from his previous training, looks upon with horror ; in short, to him almost everything around is new, the operations conducted are novelties, and the part he is to take in what is going forward is equally strange.

16. Is it just, therefore, to expect that by undergoing say three years employment in field work on the Sydapet Farms that native youths should become as competent agriculturists as are farm bailiffs in Great Britain ? Hindus and Mahomedans are ready and willing to learn more rational systems of farm management, and will, I have no hesitation in saying, make good agriculturists, farm overseers, farm superintendents, &c., but it is essential to success that the

system of agricultural training under which they are placed should be especially suited to their circumstances.

17. *Improvements, &c., on the Sydapet Estate.*—During the past year the principal roads through the Experimental Farm were entirely re-made with gravel and laterite ; and the grass sidings, which were previously much higher than the roads and caused injury to them during the rains by preventing their proper drainage, were cut down to a level sufficiently low to allow of the surface of the roads being well drained. The work was costly, but the good effect will be experienced for years. About four acres of land rendered almost barren from the ill-effects of swamp cultivation was subsoil drained and restored to a healthy state. A large cart-shed was built at the Experimental Farm buildings, there not having been a cart-shed there previously. This shed consists of a tile roof on palmyra rafters and reepers supported by pillars formed of brick built in lime. A considerable amount of levelling was done in the fields on both the Sydapet Farms. All necessary repairs were done to buildings, bridges, &c., on the estate. A large number of cocoanut trees were planted out that had been raised on the farm from nuts, a number of these were planted around the buildings on the Experimental Farm to afford shade, most of them are growing luxuriantly.

18. *The Wudder Settlement on the Sydapet Estate.*—In the centre of the Sydapet Farm estate there is a plantation of tamarind trees which covers about six acres of land ; in this plantation there are one hundred and fifty leaf-huts occupied by a colony of Wudders, who are said to be the descendants of persons who were brought into the district to work on the estate. When counted on the 23rd of April 1872 these people numbered 201 men, 218 women, and 250 children ; total 669 persons. The ground on which these huts stand is now almost entirely surrounded by cultivated land.

19. The settlement is a very serious nuisance, not only because, from the situation of the huts, many people are brought through the farms during both night and day over whom it is impossible to exercise any control, unless we incur a serious expense in employing a large staff of watchmen, but chiefly because it is a nursery and hot-bed of disease. Health statistics were collected amongst these people from the 1st of August 1872 until the end of June 1873 ; during these eleven months there were twenty-four deaths, and possibly some deaths may have occurred when the people were temporarily residing away from their huts, and may not have been registered. Taking the registrations for the eleven months, the annual death-rate was 38·86 per thousand, a very high rate. During the same period there were 243 cases of illness amongst these Wudders, that is, separate attacks of sickness, each sufficient to prevent the sufferer from attending to his or her usual work ; the names of a few of the people occur more than once in the sick list, but most of the cases were distinct attacks on different individuals varying in duration from one day to 14 days ; making a full allowance for the persons who were sick more than once, it appears that one in every four persons in this settlement was attacked by illness. The sickness generally was dengue and small pox ; the former produced a greater number of cases, but not a greater amount of real sickness, than was experienced in former years when the people were attacked by small-pox and intermittent fever of a severe type and by cholera.

20. The entire removal of this Wudder settlement to a healthier and more suitable locality is now, I believe, absolutely necessary. Something could be done to improve the sanitary state of the place where the people now reside, but the cost of effecting any substantial improvement would be great. Thus it would be necessary to take down many of the huts and re-construct them on other portions of the site, a number of trees should be cut down, and the brushwood should be entirely removed ; the waste-water channel, which forms the northern boundary of the site, should be deepened, the numerous cuttings and holes in the ground where the huts stand should be filled up in order to prevent the accumulation of filth, but to effect these improvements a considerable outlay would be necessary, while a large annual expenditure for scavenging &c., would be needed.

21. But such an expenditure would yield no good results if the Wudders belonging to this settlement, when engaged in contract work and residing at a distance from Sydapet, are to be allowed to send here those of their number who are attacked by disease during such absence. Living at these times under conditions so unfavorable to health, and exposed to attacks of contagious diseases by associating in large numbers with others of their class from other localities, they keep the settlement here well supplied with material for the dissemination of disease in this neighbourhood.

22. Instead of spending money in attempting to improve the place where these Wudders reside, it would be much less costly, and better in every way, to purchase a suitable piece of ground of sufficient area and present it to the people as a site for a village, and to pay them compensation for their trees growing on the farm land. In planning a village it would be easy to arrange for the proper distribution of the huts to admit of sanitary matters receiving due attention.

23. This settlement now puts the Experimental Farm to a considerable annual expense ; thus during the year ending the 31st March last its outlay on this account was Rupees 281-1-3, while the income from the rents collected from the people amounted only to Rupees 113-10-0.

24. This colony of Wudders is of but little value in affording labor for the farms ; as a general rule the people prefer to take contracts in connection with roads, railways, tanks, and other extensive undertakings rather than to work regular hours on a fixed daily pay ; it is not, that they can earn throughout the year a larger average daily pay than they could earn on the Sydapet farms, but by excessive labor under contract rates they can make sufficient to enable them to indulge occasionally in the luxury of a few days of idleness ; it is only when there is nothing attractive offering in contracts that we can secure their services, and this is generally only when from the state of the weather excavating and similar work is costly.

25. *Snakes and other vermin killed on the Sydapet Estate.*—During the past year the following snakes, squirrels, and rats were killed on the two Sydapet Farms :—

Cobras	54
Other snakes...	555
Squirrels	70
Rats...	170

The rewards paid are very trifling ; thus we pay for a cobra 2 Annas, for any other snake 1 Anna, for a squirrel 1 Anna, and for a rat ¼ Anna; small as are these inducements they have had a very satisfactory effect ; large snakes are now seldom met with on these farms, whereas about four or five years ago they were very abundant. No deaths from snake-bites have occurred amongst farm employés during the last six years, though several have been bitten ; but during this time two or three persons unconnected with the Farms, have died from bites of snakes inflicted when on farm land.

26. I was warned when I first began to kill all snakes indiscriminately on the Sydapet Farms that the crops would suffer severely from attacks by rats which would increase greatly in numbers ; rats are certainly very troublesome, but not more so than they were before we began to kill the snakes ; indeed, as far as it is possible to judge, I think we have fewer now ; we encourage the presence of the mungoose, of owls, and cats amongst our crops, and these keep down the rats.

27. The only way of keeping down dangerous snakes is to kill all the snakes met with ; there is such a similarity in the general appearance of many poisonous and harmless snakes that it is quite impossible during the brief time that a snake is in a man's power that he can distinguish whether it is a poisonous or a harmless variety, and any attempt to do this generally results in the escape of the snake. Harmless snakes may serve a useful purpose where there is much prickly-pear and other dense low growth of a jungly character covering the ground, but in open cultivated country, owls, cats, and the mungoose are quite able to keep down the rats.

28 One very clear result of keeping down the snakes is a very large increase of birds on the estate ; these may to some extent prove injurious at harvest time, but the good they do at other seasons far more than counterbalances this. Our crops enjoy almost perfect security from attacks of insects, ants excepted. Our summer crops, which generally mature when there are no other grain crops growing in the neighbourhood, are severely attacked by birds, but these come from a distance in large flocks, and are chiefly parrots and wild pigeons. I believe that our field crops suffer far more from squirrels than from rats, and these destructive little creatures are much more difficult to capture ; they are especially destructive on crops just appearing above ground, in nipping off young shoots, maize is especially injured in this way. Snakes may to some extent keep down these pests also, but the same would be effected by cats, the mungoose, &c.

29. *Agricultural Exhibition.*—An agricultural exhibition was held on the Experimental Farm in February last ; it was the first of a series of similar exhibitions which it is proposed to hold in selected parts of the Presidency. Exhibits were sent to it from each district, also from Travancore and Cochin ; its entire management was entrusted to this Department. The land selected for the exhibition grounds was about ten acres in extent ; the sheds, which were built to accommodate not only the produce and machinery but also the whole of the live stock, were very extensive, there being in all nearly two acres of roofing ; though they were only for temporary use, it was necessary to make the sheds sufficiently substantial to guard against the effects of a sudden storm, while the roofing had to be sufficient to protect visitors from the heat of the sun. Owing to the short time at our disposal for making preparations and the enormous quantity of material required, it was only by the exercise of great exertions that we succeeded in getting ready the accommodation necessary by the date fixed for opening. The exhibition was, on the whole, a success, making due allowance for the difficulties that had to be overcome ; but, as I have already submitted a special report, it seems unnecessary to make any further references to the matter here.

30. *The absence of a local demand for superior agricultural productions.*—Much difficulty is experienced in meeting with purchasers for live stock and field produce of a superior kind, if a price is demanded that bears any fair relation to the cost that has been incurred. Until there is a very general improvement in the agricultural practice of this country, this difficulty is likely to continue. Favorable commercial results can never be secured by farmers who raise superior stock and produce (necessarily at a heavy expenditure of time and money) unless they meet with a ready demand at fair prices for such superior productions.

31. The English breeders of stock, who have become famous in all parts of the civilized world from the splendid results they have achieved, would have remained unknown and their skill would have been unappreciated had there not been men equally as intelligent and enterprising ready to buy at reasonable prices whatever their skill produced. The high state of excellence to which certain races of cattle and sheep have been raised, is to be attributed almost entirely to the fact that there existed a ready demand for such excellence, a demand which fully recognized the cost of producing such superiority.

32. Not only is there as yet no demand at fair prices for superior breeding stock or field seeds amongst the so-called farmers of this country, but there is no wholesale demand for properly fattened stock or other superior agricultural productions ; the raisers of such having no choice but themselves to retail the produce to consumers, and here, setting aside all considerations bearing on the unpleasant necessity of the farmer having to become a retail dairyman, grain-seller, or butcher, a serious difficulty presents itself, *viz.*, the difficulty of keeping up, from any single farm, a continuous supply of such produce sufficient to meet a regular retail demand ; in this country field produce comes in with great irregularity, which must continue to be the case as long as our operations in the field are so materially affected by the weather.

33. There is undoubtedly a market for superior productions suitable for export, provided they can be raised in sufficient quantities. Small parcels receive little or no attention from merchants

unless the prices ruling for ordinary productions of the kind are accepted ; thus the enterprising cultivator, who grows a few acres of Carolina paddy, maize, or New Orleans cotton, finds, when ready for market, that these superior productions will bring him in no more money than those he ordinarily raises, because the local demand cares not for superiority, and, because the quantities are too small for export; this latter difficulty will, of course, disappear as these productions become more generally grown, when also will be generated a demand for seeds for raising these superior crops. It is now exceedingly disheartening to the cultivator who has been sufficiently enterprising to grow one or more of these improved crops to find, as has often been experienced, that the money returns obtained are but very little greater than resulted from the cultivation of the indigenous crops they displaced.

34. While such are a few of the difficulties experienced on first introducing new crops, the difficulties attending attempts to improve agricultural live stock in this country are equally great. I have again and again met with persons who, with creditable enterprise, have purchased good stock, and have gone to much expense and trouble in breeding and rearing the produce of this stock in the hope that at any rate the actual expenditure would have been recovered, who have had to complain that even this modest expectation has not been realized; this was not from any want of judgment in selecting the stock or deficiency of skill in their management, but simply because there was no demand even at moderate prices. The fact is natives generally who, of course, are the only extensive stock-owners in this country, cannot yet be made to comprehend that a well-bred bull which has been properly reared may be much cheaper at 150 Rupees than an ordinary bull reared under their usual management is at 60 Rupees. Early maturity, propensities that will give a large return in milk or in meat for the food consumed, good constitution, shape, size, &c., count for little in their estimation. I do not here allude to animals of breeds that have been introduced, which may not be altogether suited to the present condition of our agriculture, but to superior animals of indigenous breeds.

35. Disheartening as these facts appear to be, they are not less encouraging than might have been expected, seeing how ignorant and prejudiced our cultivators are. In every country reforms are difficult to carry out where they seek to improve customs that have long been in operation, and the improvements that we would effect in the farming of this country go to the very root of customs which have been adopted for generations. Mere self-interest will never effect reforms amongst a people who are uneducated and so superstitious as our ryots ; it is not to be supposed that they are less avaricious than other people, but they have not the intelligence to see what is their own interest.

36. *Fish-preservation.*—The river Adyar forms the boundary of the Sydapet Farm estate no the southern and eastern sides ; the portion thus owned by the estate is about two miles in length with a width of about 25 yards, that is, half its average width, as the claim extends only to the centre of the river. The Adyar drains and flows through a very poor country ; the greater part of its water is the overflow and wastage of several large tanks situated some miles to the west of Sydapet ; its flow is perennial, though very slight in the hot season. During September, October, November, and December a large quantity of water passes down, and occasionally the river is very much flooded. Where it begins to form the boundary of the Experimental Farm it swells out to a considerable width, and again contracts after passing the farm buildings, thus forming a basin of considerable area, in this its depth varies from four to twenty feet ; as it flows eastwards its width gradually lessens until at one place it is not more than fifteen yards wide ; here an anicut has been placed, which has had the effect of raising the height of the water on its upper side at the least four feet ; below this anicut the river again gradually widens to about fifty yards, which is about its average breadth for the next mile ; below this, and to the sea, a mile or two further down, it widens considerably. Excepting the anicut just noticed, the channel of the river is quite free from the sea, up to where the river ceases to form the boundary of the farm estate ; but at times when the flow is slight, the sand thrown up by the surf waves, where it enters the sea, accumulates to such an

extent as to block up its channel until a flood in the river again opens it. When the channel is open, the tide comes up regularly all the way to the anicut ; we have thus salt water on its lower side, and fresh water on the upper side ; the level of the salt water at high tide being generally only about three feet below the level of the fresh water, large fish can readily pass up the stream. There is no obstruction whatever to their passage up when the river is flooded, as at such times the surface of the water is perfectly level on both sides of the anicut. If the land on the opposite side of the river could be purchased, as has been suggested, for use as a stock-farm, the whole rights to the river over two miles of its length would thus be secured for experiments in pisciculture. Nothing really satisfactory can be done in utilizing the portion of the river belonging to the estate, until the purchase suggested has been effected, or until the law sufficiently protects fish.

37. I have endeavoured during the past four years to protect the fish in our fresh water from wanton destruction. The result has, I consider, been very satisfactory. I had a portion of this water netted in the beginning of last year and found that there was an abundant stock of fish, some hundredweights having been brought ashore ; the variety of fish most common was one resembling very much an English roach known to natives as "Sale;" it is a handsome fish averaging from 1½ to 3 pounds in weight ; another variety very abundant was a fish known to natives by the Tamil name "Aery Valay ;" it is a long fish varying in length from 20 to 30 inches, and weighing from four pounds up to seven pounds, both of these varieties are highly esteemed by natives.

38. There is at present, I believe, an enormous waste of human food by the reckless way in which our tanks and rivers are fished ; the majority of the nets used are not more than a quarter of an inch wide in the mesh, while many nets are used of a much smaller mesh, consequently a large quantity of young fish are taken with those of a more useful size, the best are selected, and those too small to be of use are rejected and left on the spot where the net is emptied. I do not remember ever having seen a native fisherman return to the water the small fish not required by him, all act with perfect disregard to the future ; unfortunately the anicuts, weirs, and other impediments in the channels of rivers made for irrigation purposes have rendered it much more easy for the fishermen of the present day to slaughter fish than formerly was the case.

39. *The Field-Laborer.*—One of the first results that will be secured by the gradual adoption of a better practice in Indian agriculture will be an improvement in the condition and prospects of field laborers. At present the condition of this numerous class of people is most unsatisfactory ; not only are their individual earnings exceedingly small, but they are very irregular in amount. In the best seasons of the year the income of the field laborer is but just sufficient to meet the requirements of himself and family ; in unfavorable seasons, these people are in a very destitute state.

40. The ryot employer of labor treats his employés like he treats his cattle ; at the end of the cropping season, or when the weather is unpropitious for out-door employment, he turns them away to depend on their own resources. In most parts of the Presidency the laborer is generally paid in field produce. In the neighbourhood of Madras the annual remuneration given to an adult field laborer, in the employ of a ryot, is two Pagodas, or seven Rupees, and one cloth yearly, and three meals of food per diem. When the laborer is sick the daily supply of food is stopped.

41. On the Sydapet Farms the laborers are paid at the rate of five Rupees per mensem for ordinary men and six Rupees per mensem for ploughmen, but they are paid only when actually employed. Excluding Sundays, most of them lose one month in the year from attacks of fever and other sickness ; the total income earned by the ordinary laborer is, therefore, in most instances, only about four Rupees per mensem, out of which it is frequently necessary to pay house-rent. Sometimes the wives of the laborers work in the field, but their earnings on an average in the year will not add more than a Rupee per mensem to the earnings of their husbands, in such instances bringing the total income of the family up to say Rupees five per mensem, with which must be purchased everything needed.

42. The frequent attacks of sickness to which people of this class are exposed, and the absence of all income at such times keeps them nearly always in debt to the bazaarmen. During an outbreak of disease in a district or when food is scarce and dear, it is not at all surprising that such great numbers of these people die.

43. As long as the present low agricultural practice is the ordinary practice of our ryots, there is but little hope of any improvement being made in the condition of their field laborers When, under a more enlightened practice, our ryots begin generally to grow the more valuable kinds of field crops, there will be some hope that the condition of the laborers will be somewhat less miserable than at present.

44. *Live Fences.*—The appearance of the country might be greatly improved if our ryots could be induced to plant live fences around their fields ; such fences would be of use in many ways, they would protect crops from damage by trespassing cattle, they would moderate the force of the wind, and lessen the losses that are sometimes experienced about harvest time from the effects of storms ; they would render the herding of cattle and sheep unnecessary, and be of use in many other ways, but their chief use would be to afford fuel for domestic purposes, the cattle dung now used by the ryot as fuel being set free for use in a legitimate way.

45. There are many kinds of shrubs admirably adapted for forming fences, each suited to the various conditions met with in different parts of the Presidency. One of the most generally useful is the corkapilly (*Inga dulcis*) which resembles the English hedge-thorn very much in general appearance, and which has been grown on a considerable scale on the Sydapet Farms. A hedge of this shrub can be raised at a very moderate expenditure of labor, it is only necessary to dig a trench about 1½ feet deep and 12 inches wide along the line of the proposed fence, and to fill this trench with a mixture of good surface soil and any manure that is available ; when this is done the seed is to be sown, say in three parallel lines at equal distances in the trench. If the seed is put down with the first showers of the monsoon, it will be unnecessary to use water ; if, however, sowing is done in the dry season, which perhaps the ryot will find the most convenient time in the year, he having then no urgent field-work to engage his attention, it will be necessary to apply water regularly until the seedlings are at the least one foot in height ; but good treatment is not lost on a hedge of this kind ; a fence that is properly started is always the least costly to maintain in good order. After the second year the hedge may be cut regularly once a year, and will yield a large quantity of excellent fuel. When established, a mile of such a fence under fairly good treatment in a climate similar to that of Madras will yield annually from 30 to 40 cart-loads of cuttings, most of which would be well suited for use in the house of the ryot. The cutting should be done only after the monsoon has passed over, thus securing the fences, when at their full height, to protect growing crops from the ill effects of the high winds that prevail during the monsoon.

46. *Deep and shallow cultivation.*—Some most mischievous opinions have recently been spread through India regarding the effects of deep cultivation in hot climates ; I feel it my duty, therefore, to state most unreservedly that the result of my six years' experience in actual cultivation in one of the hottest parts of Southern India has convinced me beyond all doubt that the advantage that the Madras farmer will secure by deeply tilling his soil can scarcely be overrated.

47. Shallow cultivation is the curse of Indian agriculture, and the man who can induce the ryot to add an extra inch or two to the depth his tillage operations extend, will be as much entitled to the gratitude of his country, as the man who makes two blades of grass to grow where only one grew before.

48. Now in referring to deep cultivation or deep tillage I do not necessarily mean deep ploughing ; it is here, I believe, where the mistaken opinions before noticed have originated. By deep tillage or deep cultivation I mean that the soil must be deeply stirred or loosened by the cultivator, the subsoil plough, &c. As a general rule all soils will be benefited that are thus

treated ; but the case is different with deep ploughing when the soil is unfitted, as there are many soils that would be temporarily injured by being suddenly deep ploughed, such soils for instance as those resting on a tenacious soapy subsoil, which in the process of deep ploughing would be brought to the surface and would render the surface soil unproductive until physical and chemical agencies had again restored it to a condition fit for the growth of crops ; and it would be equally as unwise to bring up to the surface, by working the plough more deeply, portions of a subsoil which is poorer than the surface soil, or that is calculated to injure the surface soil in its physical character.

49. As a general rule deeper ploughing should be done gradually, that is, the process of deepening should be the work of time, though there are soils that may be deepened at once without any bad results following. It should be remembered that in deep ploughing the under soil is always brought to the surface, while in deep cultivation the under soil or subsoil remains in its original position, its particles being merely loosened, thus allowing a free passage for air and water.

50. A dry season brings out in a decisive way the results of deep culture; during the long drought experienced last year the maize plants growing on a piece of land on the Experimental Farm that had been subsoil drained in the previous year, were more than twice as large, and proportionately luxuriant that grew over the newly-filled drains, than the plants that grew on the land between the lines of drains, the former during the greatest heat were always remarkably luxuriant, they drew their supplies of moisture far down below the parched surface soil, while the plants on the intervening spaces were puny and sickly, their roots not being able to penetrate more than a few inches below the parched upper soil. Similar results I have always obtained whenever I have had the soil deeply cultivated. I have gradually year after year deepened the cultivation on the Sydapet Farms until the soil is fully 50 per cent. deeper than similar soils under ordinary native farming, and I would gladly go deeper still ; indeed I feel sure that we can never secure good average results from our farming until we do cultivate deeper. In the hottest season the crops on the deeply tilled soil are generally fresh and luxuriant in appearance, while those growing on shallow soils are parched and withered.

51. *Want of enterprise in the Ryot as shown by his carelessness regarding the quality of the field seeds he sows.*—Native cultivators pay but little attention to the quality of the seed they sow ; this neglect is the result of ignorance or apathy, it cannot be said to be the result of want of means—the too common apology offered for all the shortcomings of the ryot—for in many cases a little personal labor expended in separating the seed is all that is required. The extra cost of the seed for an acre of land of the quality it is advisable to sow would seldom be more than one rupee, while the return obtained from this seed may be many rupees greater than the return from inferior seed.

52. Again native cultivators will persist year after year in sowing seed the produce of their own land, rather than put themselves to the trouble of sending a few miles for fresh seed the produce of soils of a different description to those they cultivate.

53. There are those who profess to believe that the ryot is a sharp-witted man, keenly alive to his own interests, and these persons are frequently informing us that if agricultural reformers could but show the ryot how to make money by adopting improved practices in agriculture, he will be found most ready and willing to receive and act upon any advice given to him ; but this is a mere delusion ; ignorance, superstition and custom are not less powerful in India than in other countries. More is needed to fit a man to make money than a mere desire to possess it ; most people possess this qualification in plenty, yet all are not rich. The fact is, that in no industry, can ignorance and prejudice produce such serious consequences as they do in agriculture. Intelligence and enterprise are essential to success in modern agriculture.

54. The loss that results from the use of bad seed and from thick seeding will, I have little doubt, annually represent a sum equal to, at the least, one half of the sum paid per acre in the form of Government assessment on the arable land of this Presidency ; in other words by the

exercise of a little intelligence, and by the expenditure of a small amount of labor, most Ryots holding arable land could reduce their annual assessment fifty per cent.—a result which I should imagine all would be glad to secure—and yet how few there are who could be induced to put in force the means required to produce these results.

55. It is education, not example, that is at present so urgently needed to improve Indian agriculture. Educated intelligent men will follow a good example ; but ignorant superstitious people never will, they prefer to trust to witchcraft, magic, &c.

SYDAPET EXPERIMENTAL FARM.

56. *Cattle.*—With the view of effecting some improvement in the cattle of the district around Madras, it is intended to import a few animals of the Aden breed. One bull, two cows, and two calves have been purchased, for shipment from Aden to Madras by the first favorable opportunity. The Adens have a high reputation as dairy animals ; the name Aden by which they are distinguished has probably originated from Aden being the port from which cattle of this breed are generally shipped, they are not found in the neighbourhood of Aden, but are brought from districts situated at considerable distances from the coast. They are small animals, and the bulls of the breed are therefore better suited for use in the early stages of experiments in improving the breeds of small cattle generally found in Southern India than are bulls of the Nellore and Mysore breeds, which in some instances have been used for this purpose. To show how great a mistake it is to use bulls of these large breeds in attempting to improve the cattle of Southern India, it is only necessary to mention that a cow of an average size generally weighs from 200 to 300 lbs. live weight, while a good bull, of the Nellore, or Mysore breed will weigh from 900 to 1,000 lbs.

57. In attempting to improve breeds of cattle, great care should be exercised in order that the increase in size bears a strict relation to the supply of food available. In most parts of this Presidency during the dry months, even in a moderately good season, the food available is scarcely sufficient to preserve the lives of the undersized cattle kept by ryots, and would, therefore, be totally inadequate to do even this much for animals of a larger size.

58. Before taking steps for improving the size of the cattle in the more backward parts of the Presidency, it is necessary that something should be done to induce ryots to grow fodder, &c., as food for their live stock. As long as so many ryots consider that it is more economical to allow their cattle to starve or even to die in the dry season rather than to go to the trouble of growing fodder for their use, it will be exceedingly unwise to attempt to increase the size of the cattle they keep.

59. The increase in the size of the draught cattle of Southern India is highly to be desired ; greater size means more strength, deeper cultivation, better crops.

60. Native cattle like native laborers can adapt themselves readily to the bad conditions with which they have so frequently to contend. A cooly, while work is abundant and food cheap, takes his three meals per day ; as the work becomes less abundant or food dearer he reduces his allowance to two meals per day, and he will manage to exist even on one meal per day when out of employment or food is very dear. The starving process is gradual ; the people become accustomed to it. It is the same with cattle ; they can be starved down to, and be kept alive, for a time, on a daily allowance of food that would represent only a tithe of the quantity they could consume when in full health. This is the ordinary process to which they are subjected every hot season at the hand of their owners. But while it is possible to reduce gradually the daily food of a bullock until in amount it would not be one-tenth of the allowance that should be given, it is not so easy again to increase without injury the daily allowance of food to the quantity necessary to support the animal in health ; hence the enormous losses that are experienced in this country amongst live stock when after a long drought a sudden fall of rain produces a luxuriant and plentiful

growth of grass. Few cattle die directly from starvation; the deaths in most cases are the result of the sudden supply of succulent food in abundance, greedily eaten by animals whose constitutions have been weakened by a long and gradual starving process.

61. It has been suggested that a stock breeding and dairy farm should be attached to and worked in connection with the Experimental Farm ; to be employed as a portion of the Educational Machinery to be used in training agricultural pupils. It is certainly very desirable that due attention should be given to stock breeding and dairy farming here, not merely for the reasons given, but also because these important branches of agriculture greatly need attention, and they will never receive proper attention until Government has led the way and shown in what direction improvement can be effected.

62. Fortunately there is a piece of land available, measuring about 300 acres which is separated from the Experimental Farm only by the river Adyar. It is true that the river when in flood will prevent intercourse between the two farms excepting by means of the bridge at Sydapet, but this would only be for a few days in the year, and would be but a trifling inconvenience in comparison with the advantages that the proximity of the river confers on the site. The land is not at all of the quality I should select for a grazing farm ; a portion of it is a good average soil, but much the largest area is very inferior. The great advantage the site possesses is its proximity to the Experimental Farm, thus rendering it unnecessary to erect special farm buildings, and enabling the undertaking to be managed under the direct control of the officer in charge of the Sydapet Farms. The land is capable of much improvement, and this improvement could be effected at a cost sufficiently moderate to justify the expenditure, provided the land can be purchased at a price bearing a just relation to its present condition.

63. The operations of such a farm might begin by buying up the best of the calves born in Madras, of which there are a great number every year, most of which are at present turned to no useful account. The cows are in most instances the property of residents whose only anxiety is to get as much milk as possible. As many of these cows are good specimens from the best districts, while a small number are animals that have been imported from Australia, their calves are well worth attention, and they could, I think, be purchased at very moderate prices.

64. After the undertaking has been organized, attempts might then be made to establish a herd suited to the requirements of the district.

65. Probably in the good grazing districts of the Presidency in Salem or Nellore, better results might be obtained in stock breeding than at Sydapet, and it might be well in these districts to start some such undertaking ; but we need to commence our educational work at once, and we seem to have in the land referred to many important advantages which a site in the more remote parts of the Presidency would not possess. It seems unnecessary to refer to this matter at greater length, as I have already prepared a separate report on this subject.

66. *Sheep.*—The sheep breeding experiment continues to progress in a satisfactory way. There is a decided improvement in the quality of the wool now obtained from our sheep ; when we commenced the experiment the wool yielded by most of them was exceedingly coarse and almost quite straight ; it is now finer and is a great deal more curled. There is, of course, very much yet to be done before the average quality of the wool is even moderately good, but the improvement that has been effected is very encouraging

67. At one time I feared that in this hot climate but little could be done towards improving the quality of wool ; but though the intense heat is a great drawback we possess one advantage over people resident in a cold climate in being able to grow crops throughout the year for the use of sheep, and this is a very important advantage in wool growing. When sheep are alternately starved and overfed, their wool is always very irregular in strength and quality, the portion of the staple produced during the period when food was scarce being always weak.

68. As our experiments have shown that we can produce green food throughout the year, I now see no reason why we should not ultimately produce fine wool ; it must be remembered that

some of the finest wools produced in the world are grown in countries in which the temperature has a high average range ; for instance in Spain, Southern Germany, the Southern States of America, the Northern Districts of Australia, &c.

69. It will, of course, take a long time to produce a fine wool from the Sydapet breed of sheep ; but by judicious crossing with fine wool-producing breeds that will stand the intense heat experienced in Madras during the hot season, we may bring about the desired results in much less time.

70. I hoped that the Chinese breed of sheep would have proved useful for this purpose, and accordingly obtained recently from China three ewes and two rams, but they will not, I fear, be able to encounter the heat of Madras; they already seem to suffer greatly. The wool of these sheep is very much superior to anything that we have yet produced at Sydapet ; we may, therefore, hope if these Sheep, live to effect some considerable improvement in the quality of our wool. It is chiefly in the wool that these Chinese sheep are superior ; they are not better animals for the butcher than are the Sydapet sheep, and their broad flat tails do not add to their value. If these imported sheep live, experiments will be made by putting the rams to a few selected ewes of the Sydapet breed, while a ram of the Sydapet breed will be put with the ewes of the Chinese breed. I hope that the latter cross will result in the production of lambs with tails of the ordinary size, as the heavy flat tail is a great disadvantage, it so frequently becomes diseased.

71. *Pigs.*—Four pigs, two boars, and two sows were recently imported from the south of China, and are now on this farm ; they, like the Chinese sheep before alluded to, appear to suffer greatly from the heat. There are two principal breeds of pigs in China, a large and a small breed ; it is the latter that we have introduced. The pigs kept at this farm are rather too large for killing as pork ; it is hoped that a cross with the Chinese will result in a variety more suited in size to meet the general demand.

72. If pigs receive proper attention, there is, I believe, no more useful agricultural stock in this country. As generally managed by natives, pigs are the scavengers of the village ; hence the disrepute into which country pork has fallen. It should, however, be generally known that the cattle and sheep of the ryot, when kept in a half famished state, are quite as filthy in their habits. Pigs that are properly housed and fed are almost as cleanly in their habits as are cattle or sheep under similar condition.

73. I have before recommended pigs as suited for keeping to supply the wants of European households on coffee estates and in other places where it is almost impossible to get butcher meat fit to eat, and I would again direct attention to the matter ; pigs can be reared under conditions quite unsuited for rearing sheep, and under artificial feeding a pound of pork can always be produced at a cost very much lower than a pound of mutton.

74. *Cotton.*—When I first attempted to grow cotton on this farm, I was frequently informed that the experiment could yield no good results, as it had been ascertained beyond all doubt that the climate of the district was altogether unsuited for the healthy growth of this plant ; while general experience had proved, in an equally conclusive way, that cotton could not be raised on a poor sandy soil such as that which forms so considerable a proportion of this farm.

75. This opinion was very general, thus the Collector of Chingleput in a report to the Board of Revenue, dated 7th June 1869, explaining why he had failed in getting any cultivator to take some cotton seed which had been sent to his office for distribution, says : "Due notice was given in the District Gazette, and the various farmers and proprietors were invited to apply for the seed, but no applications were received, the fact being that in this district little or no cotton is grown, the soil being quite unfitted for it." Again the Honorary Secretary to the late Farm Committee, in a report, dated 23rd June 1869, explaining to the Board of Revenue why certain cotton seed sent by the Board for experimental cultivation had not been sown, says : "The soil of the Government Experimental Farm at Sydapet is of a very sandy description, and the Committee considered it was useless to try the experiment of growing cotton."

76. I was, however, not satisfied to let the matter rest here. I believed that far too much trust was placed in the opinions expressed by the ryots of the neighbourhood; I found on comparing the meteorological registrations of the district with those of the regular cotton-growing districts that there was nothing in the climate prejudicial to the growth of cotton, while the soil, though very much inferior to the so-called cotton soils, could, I believed, by the aid of manure, be rendered sufficiently fertile.

77. My first experiments were made on a small scale; the results afforded were very encouraging. I repeated the experiments again and again, each time on a larger scale, and now cotton is one of the ordinary crops of this farm. The variety I prefer is the New Orleans; it is especially suited for high cultivation to which it has long been subjected; a dressing of manure that would be necessary to render our inferior soils fit for producing cotton would cause plants of the indigenous variety to run to stem and leaf instead of increasing the yield; whereas the yield of the New Orleans plant under similar circumstances would be largely increased.

78. It is true that on inferior soils such as we have here cotton cannot be raised without the aid of manure, whereas on the more fertile soils of the districts in which cotton is grown it can be produced without manure; but the yield is always very small, seldom more than one-fourth the quantity that could be raised on the same soil if properly cultivated and manured. On the Experimental Farm, crops that have yielded 200 lbs. and upwards of clean cotton per acre have repeatedly been produced, while the average produce in the cotton districts is only 75 lbs. of clean cotton per acre.

79. There are thousands of acres of land around Madras in no way inferior to the soils of this farm, now lying bare during two-thirds of the year, and during the remainder producing wretched crops of varagoo and horse gram, which might be made to yield remunerative returns under cotton; the extra expense on cultivation and manure would be morethan counterbalanced by the smaller cost of conveying the cotton to the shipping port.

80. I have in former reports given full and minute details of the cultivation, &c., of the experimental cotton crops which have been grown here, but I have not been able until now to place on record anything showing the *quality* of the cotton raised further than what could be gathered from the price obtained in the local market. I was enabled through the kindness of Messrs. Walker & Co. of Madras to forward to England for sale three bales of cotton that had been grown on this farm on a soil containing nearly 90 per cent. of sand. The following correspondence refers to this cotton:—

To W. R. ROBERTSON, Esq.,
Supt. Govt., Farms, Sydapet.

Dear Sir,—We beg to hand, herewith, extract from letter received by us yesterday from our London Office, giving Brokers' report and valuation of the three bales cotton received from the Government Farm and shipped by us per *Sultan* to London. You will observe the staple is complained of as "weak," and we think this is owing to its having been torn in the process of ginning. We might mention that while your cotton is valued at 6⅝*d.* per lb. we have sales of Fair Western's by same mail at 6*d.* per lb.

Madras,
17*th November* 1873.

We are, &c.,
(Signed) WALKER & Co.

"We hand you as under our Brokers' report upon the three bales cotton per *Sultan*.

G. F. W. Co.

8466

"We have carefully examined the sample of three bales cotton ex *Sultan* at Madras, and find it to be of an useful description of Salem character, ginned, fair color, silky, but rather weak staple, and worth about 6⅝*d.* per lb.

"This is the value which cotton of this quality would command to-day were it here in any quantity, say 50 or 100 bales. The color is good and the cotton is clean, but our Brokers complain that the staple has been somewhat injured; they presume in the process of ginning.

"I have ordered the three bales to be sold by public auction with other cotton, as the best means of ascertaining its value. But in this small quantity it is less valuable than in a lot of 50 or 100 bales."

LONDON,
24th October 1873. (Signed) WALKER & Co.

81. Unfortunately at the time the cotton reached London the markets were unusually low, or the price realized 6½*d.* per lb. would have been higher, still in comparison with the rates then prevailing the price obtained was very satisfactory; the following are the rates at the time for other varieties of cotton :—

Variety.	Price per lb. *d.*
Tinnevelly	6½
Dhollera	6 1/16
Western	6
Cocanada	5¾
Bengal	3¾
Rangoon	4
American cotton, New Orleans	8½

82. I find that there is a considerable improvement in the quality of the cotton produced on the farm; it is both longer in the staple and more soft and silky than the cotton raised in our first experiments in 1871-72 when the seed was newly introduced.

83. The following results show the quantity of clean cotton now obtained from the New Orleans seed cotton :—

Date ginned.	Seed Cotton ginned.	Clean Cotton obtained.	Yield of clean Cotton per 100 lbs. of Seed Cotton.
	lbs.	lbs.	lbs.
August 10th	229	73	31·88
,, 28th	409	130	31·78

The average yield of 31·83 lbs. of clean cotton for every 100 lbs. of seed cotton is very satisfactory, seeing that the best indigenous cotton does not yield more than 25 lbs. of clean cotton for every 100 lbs. of seed cotton.

84. The Egyptian cotton plants to which I referred in my last report are still growing; judging from their present appearance they will retain their full vigor much longer than plants of the New Orleans variety. I have now had another year's experience in growing Egyptian cotton, and see no reason to alter the opinion I formed at the end of my first year's experience, viz., that this variety is a more expensive crop to grow than New Orleans. As I before pointed out it is impossible to use cattle in a field of Egyptian cotton unless the plants are growing in lines very far apart, as the branches instead of growing upwards like those of the New Orleans plant grow chiefly in a horizontal direction. Perhaps by careful pruning during a few years the

plants may be induced to grow in a more upright way. From the length of time the cotton crop is on the land frequent cultivations are required during its growth, while as weeds spring up so freely, under the light shade afforded by the cotton plants, frequent weedings are also very necessary, and the cost of performing these operations is nearly doubled if manual labor instead of cattle power is used. The yield of cotton obtained from these plants during the last year was small, but to some extent the character of the season would account for this. In the ease with which this cotton can be separated from its seed, it possesses one advantage over all the varieties of cotton that have yet come under my notice.

85. I fear very much that we will lose the variety of cotton known as the Yca Valley to which I have so frequently referred in former reports, the borer before noticed continues to commit great havoc amongst the plants, the shrubs have again and again been pruned of all their affected branches, which have been collected and burnt, but in spite of every effort the borer has continued its depredations, and many of the plants are now reduced to little more than bare stumps; the ground on which they are growing has been thoroughly cultivated and various manural dressings have been applied, but the effect was only to stimulate the growth for a time the extra luxuriance produced, apparently only affording greater scope for the depredations of the borer; we may succeed in getting rid of this pest, but if we do the seed raised from these plant in their debilitated condition will scarcely be fit for distribution.

86. The Yca Valley cotton is undoubtedly a very valuable variety; it would be well if a supply of fresh seed could be obtained from Brazil; it is not likely ever to become one of our ordinary field crops; but as Indian agricultural practice improves, this variety of cotton would take its position amongst our more valuable crops.

87. *Maize and Cotton.*—The following details refer to the cropping of the field that was recently drained, noticed under heading "subsoil drainage" in another part of this report, where will be found all details referring to the drainage operations performed.

Plot (a).

Drained by stone drains.

Area of plot, 8,800 square yards.

Preparation of the soil, &c.—The soil after being thoroughly worked and cleaned was ridged. Blood manure (a compost formed of ashes and the refuse of the slaughter-house) was then spread between the drills, the total quantity used was 36 cart-loads. The ridges were next split by the plough, one-half falling over the manure on either side, thus forming new ridges with the manure beneath, these ridges were next consolidated by the chain harrows when the land was fit to receive the seed.

Seed, &c.—On the 17th of September the whole of the plot was sown, the seed being placed on ridges which were about 30 inches apart. A line of cotton was sown alternately with a line of maize throughout the whole plot. The quantity of seed sown was :—

Maize 8½ pounds.
Cotton 8½ ,,

After cultivation.—During the growth of the crop the land was ploughed twice and hand-hoed three times.

Harvesting, &c.—The maize matured and was ready for gathering in the middle of December. The cotton crop was longer in coming into bearing, and as the weather was so exceedingly dry several months passed over before the whole crop was gathered. The maize yielded 4,147 cobs; and from the cotton plants 299½ lbs. of seed cotton was collected. When dry four of these cobs on the average yielded one pound of clean maize; one hundred pounds of the seed cotton yielded on the average 31½ pounds of clean cotton. The weight of the straw, cob skins, &c., were estimated, but these estimates were based on actual results.

88. The following statement shows the financial results of the experiment calculated per acre :—

Expenditure.	RS.	A.	P.
Ploughing and cleaning the soil	3	0	0
Ridging	0	8	0
Ten tons of blood manure	10	0	0
Carting and spreading manure	2	0	0
Splitting ridges	0	8	0
Chain harrowing ridges	0	2	0
Seed and sowing	1	0	0
Chain harrowing ridges to cover seed	0	2	0
Cultivation during growth.			
Two ploughings and three hand-hoeings	6	0	0
Scaring birds, &c., at harvest	1	0	0

Average cost of harvesting Maize.

	RS.	A.	P.			
Gathering cobs	1	8	0			
Carting to sheds	0	6	0			
Peeling, tieing, hanging, &c.	1	8	0			
Shelling	0	8	0			
Reaping and carting straw to yard	1	12	0			
				5	10	0
Gathering and ginning cotton				7	0	0
				36	14	0

Income.			
570 lbs. of maize seed at 30 lbs. per Rupee	19	0	0
52 lbs. of clean cotton at 120 Rupees per candy	12	7	8
112 lbs. of cotton seed	2	3	10
793 lbs. of cob stalks, skins, &c.	1	15	9
2,956 lbs. of straw	13	3	2
	48	14	5

General Result.	Per.	Acre.	
Income	48	14	5
Expenditure	36	14	0
	12	0	5
Deduct annual charge for drainage	4	0	0
Margin to pay rent, interest, superintendence, &c.	8	0	5

This surplus might fairly be increased to Rupees 12 by adding Rupees 4 to represent the unexhausted value of the manure used.

(*Plot b.*)

Drained by two-inch pipe drains.

Area of plot, 8,742 square yards.

Preparation of the soil.—The soil was prepared in the same way as the soil of plot (*a*). Twenty-one cart loads about 10½ tons of blood manure and 54 parahs of lime were applied to the plot.

Seed, &c.—On the 4th of September the plot was sown, 11 lbs. of maize and 9 lbs. of cotton seed sufficed for sowing the whole plot. The sowing was effected in the same way as described in referring to the sowing of plot (*a*).

After cultivation.—Two ploughings and four hand-hoeings were all the after cultivations performed.

Harvesting.—The maize did not mature until the beginning of January ; the cotton was not all gathered until several months after. The maize yielded 5,728 cobs, and the cotton yielded 404½ pounds of seed cotton. The yields of clean maize and of clean cotton were very similar to the yields obtained from the produce of plot (*a*) ; and the weight of straw, &c., were calculated from the data used in calculating the weight of straw, &c., in plot (*a*).

89. The following statement shows the financial results of the experiment calculated per acre ;—

Expenditure.

	RS.	A.	P.
Ploughing, cleaning the soil	3	0	0
Ridging	0	8	0
5¾ Tons of blood manure compost	5	12	0
27 Parahs of lime	7	14	0
Carting and spreading manure	3	8	0
Splitting ridges and ridging	0	8	0
Chain harrowing ridges to consolidate the soil	0	2	0
Seed and sowing	1	0	0
Chain harrowing to cover seed	0	2	0
	22	6	0

Cultivation during growth.

2 ploughings between rows of plants } 4 hand-hoeings. }	7	8	0
Scaring birds, &c.	1	0	0

Average cost of harvesting Maize Crop.

	RS.	A.	P.	RS.	A.	P.
Gathering cobs	1	8	0			
Carting	0	6	0			
Peeling, tieing, hanging, &c.	1	8	0			
Shelling	0	8	0			
Reaping	1	0	0			
Carting straw	0	12	0			
				5	10	0
Gathering cotton, ginning, &c.				10	0	0
				46	8	0

Income.

	RS.	A.	P.
793 lbs. of maize seed at 30 lbs. per Rupee	26	6	11
70 lbs. of clean cotton at 120 Rupees per candy	16	12	10
153 lbs. of cotton seed	3	1	0
1,104 lbs. cob stalks, skins, &c.	2	12	2
4,112 lbs. of straw	18	5	9
	67	6	8

General Result.

	Per Acre.		
Income	67	6	8
Expenditure	46	8	0
	20	14	8
Deduct annual charge for drainage	3	0	0
Margin to pay rent, interest, superintendence, &c.	17	14	8

To this surplus Rupees 5 may fairly be added as the value of unexhausted manure, making the return Rupees 12-14-8 per acre.

90. Satisfactory as are these results, they do not fully exhibit the benefits in this instance gained by subsoil draining, for it must be remembered that before the drainage was performed the land was almost hopelessly unproductive having been rendered so by swamp cultivation. The stoppage in the stone drains in plot (*a*) during the latter growth of the crop undoubtedly lessened the return that would otherwise have been obtained.

91. With further experience I feel sure that pipes will be found much more suited than stones for use in subsoil draining in this part of India.

92. Throughout the long drought which was experienced during the year under review the cotton on the pipe drained land was always green and fresh, while that growing on the undrained soils was withered and much blighted.

93. I feel no doubt whatever regarding the benefits that will be secured by the subsoil drainage of retentive soils in this part of India, but I believe that we have yet much to learn before we can venture to recommend a system of subsoil drainage for general adoption.

94. *Burmese Paddy.*—A few pounds of each of the best kinds of Burmese paddy were obtained from Rangoon. Each variety was sown on a separate plot of land, the cultivation adopted was precisely that under which indigenous paddy is placed. The general results were not good, a large number of the plants produced small inferior grain, but this may to some extent have been the result of the great change in climate, especially as the crops matured in the early part of the dry season, at which time the dryness of the air in Madras affords a very marked contrast to the state of the atmosphere most common in Burmah. Probably the grain produced by these crops will afford a seed that will yield better results next season. These varieties of paddy are much more highly esteemed by natives than the ordinary paddy generally grown in Southern India.

95. *Shamay (Panicum Miliare) as a fodder crop.*—A plot of land measuring 744 square yards was sown with 10 pounds of Shamay seed on the 2nd of August. The crop grew rapidly and with great luxuriance ; on the 25th of October, when most of the plants were coming into ear, the whole was cut down, and yielded 4,575 pounds of excellent fodder. This was dried and made into hay which, when cured, weighed 1,411 pounds. After the removal of the first cutting the plants again started vigorously, and on the 18th of December another cutting, weighing 2,673 pounds, was obtained. This, when dried, yielded 925 pounds of hay. The total return thus obtained from the plot during the four months that elapsed between the sowing of the crop and the harvesting of the second cutting was 7,248 pounds of fodder, which gave 2,336 pounds of hay, equal to 47,151 pounds of fodder, or 15,197 pounds of hay per acre.

96. The cultivations, &c., were as follows :—

2 Ploughings.
2 Harrowings.
2 Weedings.
7 Waterings.

Manured with four cart loads of fold yard manure.

97. The cost of the foregoing per acre may be estimated as follows :—

	Per Acre.		
	RS.	A.	P.
Ploughing and other cattle labor	2	8	0
Manure and carting	23	4	0
Seed and sowing	3	0	0
Weeding, &c.	3	0	0
Watering seven times	7	0	0
Cutting fodder, &c.	2	0	0
	40	12	0

or about Rupees 1-14-11 per ton of fodder, a low price,

98. I should remark with reference to these results that during the time the crop was on the ground the rainfall generally was copious, hence it was seldom necessary to irrigate ; had we been obliged to water the crop regularly throughout the whole time it was growing, the cost of producing the fodder would have been largely increased.

99. *Paddy Fodder—green, and dry.*—I have already directed attention to indigenous paddy as a fodder producer. During the past year we grew a considerable quantity of this fodder ; it is readily eaten by all kinds of farm stock ; when produced on land in a good manural condition it is of course much more nutritive than when grown under the conditions that characterize native farming. It is not so well adapted as a food for dairy stock as is cholum fodder ; a milch, cow when consuming daily 45 lbs. of cholum fodder yielded three measures of milk per diem but when paddy fodder was substituted, though a similar weight was consumed, the yield of milk was reduced to two measures ; when feeding with cholum fodder was resumed, the daily yield of milk again rose to the quantity obtained previous to the change of food. This result is not surprising when the habits of the two plants are compared ; the paddy is an aquatic plant, its growth is rapid provided it meets with a sufficiency of organic food in the soil or in the water in which it is growing, a quantity of available plant food that would suffice for the wants of a paddy crop when irrigated would be altogether insufficient to meet the wants of a dry crop ; irrigation water, judiciously applied, enables a plant to utilize thoroughly the food in its neighbourhood, not only by rendering that food more fit for assimilation, but by bringing it within reach of its roots. Dry crops, such as cholum, &c., grow steadily during favorable weather ; as their roots have but a very limited feeding ground, merely the portions of the soil with which they are in contact, it is of the utmost importance for their healthy development that the soil should be rich in plant food, much greater in proportion than is requisite in a soil under a crop of paddy.

100. Under proper manuring and careful watering the nutritive value of paddy fodder might be considerably increased, there can, I think, be no doubt, but that the most nutritive paddy fodder that could be raised would be that produced by the least expenditure of water, especially if the field was occasionally allowed to dry for a day or two in order to admit capilliary action to exert its influence in bringing up to the surface plant food from a lower stratum of soil. Though paddy fodder as generally grown is inferior to cholum fodder, there are many circumstances under which it can be raised more easily, hence its value. For making hay for future use it is decidedly preferable to cholum, not only can it be packed more readily in stacks, but it can be kept in good condition for a much longer period.

101. Paddy hay when made into chaff is a useful food for horses ; the following experiment shows the cost of this hay and the cost of chaff made from it ;—

	lbs.
Weight of green fodder weighed two hours after being cut...	4,396
Weight of hay after having been exposed 42 hours, during which time it was repeatedly turned and tossed	1,459

Expenses—

	RS.	A.	P.
Green fodder 4,396 at 400 lbs. per Rupee	10	15	10
Cost of winning and chaffing	3	0	0
Total...	13	15	10
Cost of chaffed hay per ton	13	15	10
Cost of hay per ton	11	15	10

102. *Indigenous Grasses.*—In response to a circular issued from the Board of Revenue a large quantity of seed of indigenous grasses was sent to Madras for experimental cultivation on the Sydapet Farms. Many experimental plots were sown with these seeds, but from various causes the results obtained were unsatisfactory, and but ill repaid the expense and trouble incurred. One chief cause of the want of success was that too much was attempted. I was afraid to keep the seed, the length of time that some would have to be kept, in order to allow of a series of manageable experiments being conducted in succession, and therefore attempted to deal with the whole at one time, sown in upwards of one hundred experimental beds. I soon ascertained that the experiment was far too extensive for the means then at my command, and that it could not receive justice unless by neglecting other experiments. A large quantity of results were collected, which, though unsuitable for report now, will be of use in the further experiments that I intend making ; these I propose shall deal only with grasses of one district at a time, instead of with the grasses of the whole Presidency.

103. Another cause of the unsatisfactory results yielded by these experiments was the injury done to the experimental beds by donkeys belonging to dhobies resident in Sydapet. These animals were evidently turned into the field through the gates by their owners, as the fences were in sufficiently good condition to prevent trespass. The donkeys were, of course, captured and sent to the pound whenever seen, but during night many visited the plots, and were removed again before daybreak. Some of these donkeys were captured two or three times a week, and regularly sent to the pound, when they were, with the same regularity, sold, and bought again, probably by their former owners, at from 2 Annas to 3 Annas each, when they again returned to pasture on the grasses growing on the experimental plots. Of course no dhobie could afford to keep up this practice of buying the same donkey two or three times in a week, and to some extent our perseverance in sending the depredators to the pound had a good effect ; but in the meantime nearly the whole of our experiments were rendered useless, as we could not report on the comparative yield of plots under different species of grasses which had been grazed to a greater or less extent. To make quite sure that the animals sent to the pound were really returning again and again I had one or two marked, and in this way placed the matter beyond a doubt. I have dwelt on this matter at this length, because it illustrates the annoyance to which many persons are exposed from animals trespassing upon their land; damage may be done to a serious extent by an animal that possesses almost no value, it may in the usual course be sent to the pound, but when there the owner is sufficiently discreet not to claim it lest he should thereby become liable for the damage it has done; he waits until the animal, in the regular course when on owner is found, is put up to auction, when he or a friend, buys it for a few Annas ; thus, for the small sum invested in the purchase he avoids having to pay probably many Rupees for damages done. This may seem a small matter to which to direct attention, but it is these small matters that often prove the most annoying, they are so difficult to deal with in a satisfactory way, and I have met with many persons in this country whose attempts, on a small scale, to introduce new crops have been frustrated from the custom, so common amongst natives, of turning live stock, cattle, sheep, goats, donkeys, &c., upon the public roads to seek a subsistence on the pickings there met with.

104. From the more recent sowings I am able to report a few results obtained from the experiments with native grasses ; they do not possess much value, but as a step towards a knowledge of the grasses of the country, they will be of use in future experiments.

105. It must be remembered that indigenous grasses, though their appearance above ground, their flowering season, &c., depends on the periodical rains, all possess habits more or less different ; hence it was not the best way of bringing to light their individual qualities by owing all in one kind of soil and treating the whole in one way ; still, until we possess more infor-

mation regarding the natural habits of the grasses, a comparative trial under similar conditions is the only way by which anything of a useful character can be learned.

106. The soil on which these experiments were made was a light sandy loam ; it was lightly manured, and water was applied once or twice a week according to the state of the weather. The following are the general results :—

Number of Plot.	Area of Plot.	Local Name.	General Results.				
			When sown.	When appeared above ground.	When flowered.	Yield of fodder cut when in flower.	
						Per plot.	Per 100 square feet
	Square feet.					lbs.	lbs.
1	45	Melampary	4th June.	10th June.	15th July.	15	33
6	$6\frac{7}{8}$	Pooanthu	4th do.	9th do.	15th Aug.	8	116
7	$5\frac{1}{8}$	Vellai Uttaloo ...	4th do.	9th do.	17th do.	5	94
17	6	Shagappu Shamay...	4th do.	10th do.	7th do.	$3\frac{1}{8}$	52
21	$13\frac{1}{2}$	Chinna Arricum ...	4th do.	11th do.	13th July.	$5\frac{3}{8}$	40
23	$17\frac{5}{12}$	Coopary...	4th do.	10th do.	14th do.	$17\frac{7}{8}$	103
24	$13\frac{1}{16}$	Coranee...	4th do.	9th do.	28th Aug.	8	61
25	13	Varashamay	4th do.	14th do.	15th July.	5	38
30	$6\frac{1}{36}$	Peeshachy	4th do.	10th do.	13th do.	20	166
31	$6\frac{1}{36}$	Pelampury	4th do.	10th do.	13th do.		
41	$12\frac{3}{8}$	Yerri Mylampingee.	5th do.	9th do.	12th do.	5	40
49	10	Punjapoo	5th do.	10th do.	5th Aug.	$1\frac{1}{2}$	15
58	9	Ottaray	6th do.	12th do.	1st do.	$1\frac{1}{4}$	14
65	$9\frac{1}{2}$	Corranee	6th do.	10th do.	10th do.	$3\frac{1}{2}$	37
71	$5\frac{1}{2}$	Combapree	7th July.	11th July.	12th do.	$1\frac{7}{16}$	26
75	12	Vematherity ...	6th June.	11th June.	13th July.	$2\frac{1}{2}$	21
83	10	Conally...	7th do.	12th do.	1st Aug.	8	80
87	$10\frac{1}{24}$	Chinnyga	8th July.	13th July.	3rd do.	$\frac{9}{16}$	5
90	8	Poopillu	8th do.	14th do	3rd do.	$4\frac{1}{2}$	20
91	8						
92	6						
100	$6\frac{3}{4}$	Dumapie	7th June.	19th June.	1st do.	$8\frac{1}{2}$	126

Notes thereon :—

Name of Grass.	Remarks.
Melampary	Average height 2 feet 9 inches. Upright growth without bottom grass. When green it yields a fair fodder, but unfit for making hay.
Pooanthu	Average height 2 feet. Upright growth without bottom grass. When young succulent, but wiry when it reaches maturity. Unfit for making hay.
Vellai Uttaloo	Do. do. do.
Shagappu Shamay	Average height 15 inches. Bottom grass abundant ; a moderately good pasture grass ; would afford a coarse hay.
Chinna Arricum	Average height 24 inches. A fair quality of bottom grass. Stems and blades fine, but rather wiry. A moderately good pasture grass. Makes coarse hay.
Coopary..... ..	Average height 24 inches. A coarse grass ; almost useless for pasture or for making hay.
Coranee.....	Average height 24 inches. Destitute of bottom grass. Affords a moderately good fodder, but unsuited for making into hay.
Varashamay...	Do. do. do.

Name of Grass.	Remarks.
Peeshachy.....	Average height 2 feet 9 inches. No bottom grass ; yields a moderately good fodder ; too coarse for hay.
Pelampury	Do. do. do.
Yerri Mylampingee	Average height 12 inches ; a fair quantity of bottom grass ; yields a coarse fodder.
Punjapoo	A useless grass.
Ottaray	Average height 12 inches. Has an abundance of bottom grass. Is a moderately good pasture grass. Affords hay of fair quality.
Corranee	Average height 15 inches. No bottom grass. Very wiry ; unsuited for pasture or for hay.
Combapree	Average height 12 inches. Blades coarse and short, but very succulent. Would make a useful pasture grass. Too coarse for hay.
Vematherity	Average height 30 inches. A coarse inferior grass.
Conally	Average height 15 inches. Blades short and pointed. A coarse wiry grass of little value.
Chinnyga	Do. do. do.
Poopillu	Average height 9 inches. A fair amount of bottom grass. Blades and stem tough and wiry.
Dumapie	Average height 30 inches. No bottom grass. Affords a coarse but succulent fodder. Too coarse for making into hay.

107. *Field Vegetable Crops.*—It is exceedingly difficult, in this country, in regard to many crops to determine whether they should be classed as agricultural or garden crops. When I first took charge of the Sydapet Farms I was inclined to rigidly exclude from our attention all crops that did not, beyond all doubt, belong to agriculture; while I still hold the opinion that in an agricultural undertaking it is well to avoid all vegetable crops that strictly belong to horticulture; I now think that we may advantageously, in the dry season, give some attention to such crops as plantains, brinjals, sweet potatoes, and one or two other crops of the kind which can be grown on a large scale. There is every year a few months during which there are but few field crops on the land needing attention, and it fortunately happens that this occurs at the time of year when these crops are in season. Crops of the kind referred to consume a large amount of labor, but the return obtained from them is generally satisfactory. They are chiefly valuable to the farmer in enabling him to give regular employment throughout the year to his laborers, a result which is beneficial alike to the laborer and his employer.

108. *Mixed Plantation of Cocoanut and Casuarina Trees.*—A plot of waste land consisting of poor sandy soil, measuring 1,190 square yards, was planted with cocoanut and casuarina trees, partly to utilize the ground, but chiefly as an experiment in view to ascertain the effect on cocoanut and casuarina trees of a moderate dressing of manure. A line of cocoanut trees and a line of casuarina trees six feet apart were planted alternately over the whole plot. The dimensions of the pits for the cocoanut trees were width each way 24 inches, and depth 27 inches; the pits for the casuarina trees were 18 inches deep and 18 inches wide in each direction. The cocoanut trees had been raised on the farm from nuts; the trees were fifteen months old when planted out; they were planted 12 feet apart in the lines. The casuarina seedlings were about three months old, and were bought from a nursery-man at Rupees 5 per thousand; they also were planted with intervals of 12 feet between each. The planting of the ground took place on the 11th of February 1873; there are 134 trees on the plot of which 69 are cocoanut trees. From the time of planting until the 31st of March last the ground has been irrigated twelve times and hoed five times. At the time of planting each pit was manured, four cartloads of blood manure being used for the whole plot; in February 1874 each tree was manured with two pounds of oil cake, the casuarina trees were pruned nine months after planting, and again in the following March. A few of the trees having failed, they were replaced by seedlings in November last.

109. The appearance of the trees is most promising; their further treatment will be carefully placed on record; it is very desirable that something should be done in order to provide fuel at a moderate price, and in this way set free cow-dung, &c., for use in manuring the soil, instead of as at present, being used as fuel.

110. *Results of inquiries in other countries for crops suited for field cultivation in the Madras Presidency* :—

China.—I am under great obligations to Messrs. Arbuthnot and Co. of Madras for putting me in communication with Messrs. Jardine, Matheson, and Co. of Hong-Kong, from whom I have received much valuable aid. The following extract from a letter received from these gentlemen conveys much useful information, the letter was written in reply to an application I had made to them per Messrs. Arbuthnot and Co. for a small supply of pulses and clovers, or other field-seeds suited for culture in Madras :—" We much regret that we cannot meet Mr. Robertson's wishes as regards a selection of agricultural seeds, for we know of no pulse or clover in China that would prove of much service to him. The beans produced in the Northern Provinces are grown chiefly for the oil and cake they yield, the latter being used extensively throughout the sugar-producing districts of the south. As regards clover, we are only aware of a very coarse description, which is grown to a limited extent around Shanghai, and is almost exclusively used for ploughing into ground intended for wheat or barley."

111. *Burmah.*—An application was made to a gentleman resident in Burmah, who is well acquainted with that country for a supply of field-seeds of the kinds usually cultivated by the Burmese. The following is an extract from his letter in reply:—" I think that I may say that we have no grain-crops in British Burmah in field cultivation except paddy, and the varieties of it can be counted by hundreds." He very obligingly sent a small supply of paddy of two or three of the varieties most highly esteemed. These reached Madras in good condition, and were cultivated in the way usually adopted with ordinary paddy. Though in each case a full average crop of straw was produced, the yield of grain was very light, many of the ears being quite without grain. Had these crops been sown before the full burst of the north-east monsoon, the results might have been more favorable. It is, I think, probable that these kinds of paddy would thrive better in Malabar and on the western side of the Presidency than here on the Carnatic side, where the air is generally very dry. As these varieties of Burmese paddy produce a rice that commands in the local market a much higher price than the rice of the kinds of paddy usually grown in Madras, they are well worth the attention of cultivators who reside where a favorable climate is found.

112. *Mauritius.*—Small supplies of lentils and maize were received from Mauritius in response to an application for field-seeds. The lentils are highly esteemed in Mauritius, but unfortunately they did not thrive on the Experimental Farm, where they were sown. The seed was fresh and germinated well, but the plants never exceeded six inches in height ; they flowered, but yielded no pulse. The experiment should be repeated ; it is very desirable that something should be done towards introducing a good pulse crop into this part of India. The maize grew admirably and yielded very heavily ; from 125 pounds that were sown on the Experimental Farm 5,000 pounds of clean seed were obtained.

Oil Cake.

113. *Ground-nut Oil Cake.*—I mentioned in my last annual report that the price of this oil cake had risen more than 50 per cent. in Madras and in the districts around since I first directed attention to its qualities, and that I was, therefore, obliged to seek for supplies for the Sydapet Farms in localities, where the qualities of the cake had not yet become generally appreciated. I also mentioned that I had succeeded in making a contract in Mysore for 10,000 pounds monthly at Rupees 6-12-0 per candy of 500 pounds. Unfortunately, of the first supply, 20,000

pounds, received under this contract, I was obliged to reject 8,000 pounds, as the cake, instead of being made entirely of ground-nuts, contained a considerable quantity of the crushed seeds of a purgative oil seed ; indeed, the whole of the cake received was impure, but in the cake retained there was a much less quantity of the impurity ; but, small as this was, our stock suffered severely after eating the cake. I ascertained, on making inquiries, that it is almost the universal custom in Mysore to crush with ground-nuts two or three other kinds of oil seeds, under the impression that the mixed oil is more valuable than the pure oil of the ground-nuts ; and, as the oil seeds, that are added are more or less purgative in their action when eaten, it is easy to understand why the cake should prove hurtful to stock fed on it. As the contractors stated that it was quite impossible for them to obtain pure ground-nut oil cake in Mysore, I was obliged to cancel their contract.

114. After some trouble I found a contractor willing to supply pure cake from Velloro on the terms on which the Mysore cake was to be supplied. I have now received regularly 10,000 pounds of the Vellore cake monthly, and have had every reason to be satisfied with its general quality.

115. I have referred to these matters as, during the past year, I have had a good deal of correspondence with gentlemen in different parts of the Presidency who have tried the cake in their stables and byres on my recommendation, and in several instances have obtained results the reverse of satisfactory. In the Tanjore District a gentleman, who attempted to feed his horses and cattle on ground-nut oil cake, found that the cake was eaten most reluctantly by all the animals, and that, after continuing in its use for some time, the animals gradually lost flesh. I obtained a sample of the cake used, and found it to be perfectly pure ground-nut oil cake, but it was thoroughly saturated with oil from imperfect extraction ; though the oil has a sweet, agreeable taste when fresh, it is when rancid exceedingly disagreeable, and as this rancidity is developed during the time the cake is being steeped for use, it is easy to understand why the cake was so disliked by the stock, and the presence of the oil in such large quantities would render the cake slightly purgative. It was only necessary that the oil should have been more thoroughly extracted to have made the cake a really first-class food for stock. Correspondents resident in Mysore have complained that ground-nut cake, when given to young horses, affects the action of their kidneys to an injurious extent, but the results, already noticed, of my experience with Mysore cake sufficiently explain why this is so. To one gentleman who made this complaint I forwarded a sample of pure Vellore cake with a request that he would compare it in a certain way with a sample of the cake he had been giving to his horses. The result of this comparison is given in the following extract from his reply :—" I have tried the ground-nut cake as you suggested and find it as you say. After emersion for twenty hours, the Bangalore cake is sticky and lumpy, is generally coarse, and has an unpleasant taste, while the Vellore cake which you sent me is much whiter in color, is without hard lumps in it, and is sweet to the taste." I would add to the foregoing that, in my experiments, in comparing a sample of Bangalore ground-nut cake with a sample of the same kind of cake procured from Vellore, the pieces of the former cake when put into water formed only a layer at the bottom of the glass, while the same quantity of the pieces of Vellore cake formed, after emersion for a similar time, a rich mucilaginous jelly, which rose up and entirely filled the glass.

116. From the many inquiries that have reached me regarding this valuable cake, I am led to believe that it is but little known to Europeans even in localities where it can be obtained in abundance at a low price ; the following remarks may, therefore be of use. The cake is the refuse obtained in the manufacture of ground-nut oil. The nuts are produced in the underground pods of the *corachis hypogœa*, a plant that is grown very largely in many parts of this Presidency as an ordinary field-crop. The Tamil name of the plant is Varcadalay, its Telugoo name is Varchenegaloo, and its Hindustani name is Velaycthe Moongka pulli. The plant belongs to the natural order *Leguminosœ* ; its pods, as before noticed, bury themselves in the soil.

117. The oil of the ground-nut is highly valued in Europe ; indeed, it is generally quoted at a price from 10 to 15 per cent. higher than the best linseed oil ; it is said to be largely used as a substitute for olive oil, and that it is chiefly used for preserving sardines.

DRAINING.

118. *Subsoil Draining.*—In my last annual report I referred to an experiment in subsoil draining which had been begun but a short time before the close of the year. The field selected for the experiment measured nearly four acres ; it is divided in two nearly equal-sized parts by an open channel. One of these portions, which I shall refer to as plot (*a*), measures 8,800 square yards ; the other portion, plot (*b*), measures 8,742 square yards. The whole of the field has been drained in one way under what is known as the " gridiron " system. The ordinary drains are 3½ feet deep, and are placed 24 feet apart. Each plot is provided with one main drain which runs along at right angles to the line of the parallel drains, and into which the whole of the water is discharged ; the outlet of this drain is formed of brick built in lime with an iron grate over the vent to prevent rats, &c., going up the pipes. The depth of the main drain is four feet. Stone-drains have been laid down over the whole of plot (*a*), while plot (*b*) has been drained by means of pipe-drains.

The following statement shows the cost incurred in draining plot (*a*) :—

—	Cost.			Cost per acre.		
	RS.	A.	P.	RS.	A.	P.
Cost of cutting paralled drains, 988 running yards, at 3½ Rupees per 200 running yards	17	4	8	9	8	2
Cost of cutting main drains, 97 running yards, building an outlet, and providing a grate	6	14	7	3	12	10
Cost of broken stones, 341 parahs, at 4 pies per parah, 1,658 parahs, at 3¼ pies per parah	35	2	8	19	5	6
Cart-hire for carting broken stones from quarry, 66 days, at As. 12	49	8	0	27	3	7
Cost of placing the broken stones in the drains, filling drains, &c.—25 men at 3 Annas per day and 45 women at 2 Annas per day ...	10	5	0	5	10	9
Total...	119	2	11	65	8	10

119. The cost per acre is very high, and is considerably in excess of the cost estimated in my last report. There are two reasons why this was so ; first, the coolies, not being able to use ordinary draining tools, it was found necessary to dig the drains very much wider than was originally intended in order to admit of them using their short-handled tools in the drains. This additional width caused no increase in the cost of cutting the drains, but it caused a very serious increase in the cost of the work by the necessity it created for the employment of a much larger quantity of broken stones than would have been required had the drains been cut only the usual width ; the other cause of the increased cost was the mismanagement of the carting, which, instead of being done under contract, was done by day-labor, and was not properly overlooked ; but, for these two causes, the cost of the work would not, I feel certain, have exceeded the estimate I gave : however in an experiment of such a very novel character it was not surprising that everything did not work as smoothly as might have been desired.

120. It was found impracticable to make drain-pipes on the farm in time to allow of the experiment being begun last year, and as drain-pipes could not be procured anywhere in the Presidency, I had no alternative but to use sewage-pipes, which are, of course, far too expensive, as for use in field draining these pipes are but little, if at all, superior to ordinary drain-pipes ; it would not be fair to debit the experiment with their cost; fortunately I have at hand figures of a reliable character from which the cost of manufacturing two-inch drain-pipes can easily be ascer-

tained. Since this experiment in draining was begun, we have had a considerable amount of experience on the Experimental Farms in the manufacture of two-inch drain-pipes, and this experience has afforded the following :—For an expenditure of Rupees 62 on labor and cattle-hire, 16,000 two-inch drain pipes were made and dried ready for burning, the average cost per thousand being Rupees 3-14-0 : this may be divided as follows :—

	RS.	A.	P.
Raising and mixing clay	0	6	0
Screening, &c.	0	10	0
Making pipes, rolling, &c.	2	2	0
Turning and drying pipes	0	4	0
Cart-hire	0	6	0
Other work...	0	2	0
Total...	3	14	0

As was to be expected our first attempts in burning the pipes were not attended with complete success. The kiln was but newly erected, the men were untrained, and the result was that a large quantity of the pipes was spoiled in burning. I cannot, therefore, from these results calculate the cost of the fuel used in burning the pipes. I prefer to take the cost from the results obtained during a considerable experience in pipe-burning at Home. In England with ordinary kilns it is found that 2¼ tons of coals are quite sufficient for burning 12,000 two-inch pipes; these at the Madras price, Rupees 24 per ton for coals sufficiently good for pipe-burning, would represent Rs. 4½ per thousand, but pipes do not need an intense heat; casuarina wood might be used either in part or exclusively as the fuel, in which case the cost of fuel for each thousand two-inch pipes would not exceed Rupees 4 ; a further charge of Rupees 1¼ per thousand will pay the labor at the kiln and provide a fair allowance for interest on capital employed, wear and tear of sheds, machinery, &c., making a total charge, amounting to Rupees 9-2-0 per thousand, for well-burned two-inch pipes, which is the price charged in the following statement. The price of the pipes used in the main drains is obtained in the same way. With these exceptions, the items in the following statement are the actual charges incurred in draining plot (*b*) as follows :—

—	Cost.			Cost per Acre.		
	RS.	A.	P.	RS.	A.	P.
Cost of cutting parallel drains, 1,088 running yards, at Rupees 3-8-0 per 200 running yards	19	0	8	10	8	8
Cost of cutting 95 running yards of main drain, building outlet, and providing a grate	6	13	11	3	12	10
Value of 3,264 two-inch drain-pipes estimated at Rupees 9-2-0 per thousand	29	12	7	16	7	10
Value of 285 four-inch drain-pipes estimated at Rs. 12 per thousand.	3	6	9	1	14	4
Cart-hire for conveying pipes from kiln to field	3	0	0	1	10	7
Cost of laying pipes and filling earth into the drains—29 men at 3 Annas and 53 women at 2 Annas	12	1	0	6	10	10
Total...	74	2	11	41	1	1

121. With further experience it will, I think, be found possible to reduce the cost of draining an acre of land with pipes in the way described to Rupees 35, which sum charged over twenty-five years at the rate of $7\frac{1}{10}$ per cent. per annum, which would repay the whole of the capital with interest at 5 per cent., would represent an annual charge, amounting to Rupees 2-7-8 per acre, a very moderate price to pay for the benefits that will be gained. By increasing the depth of the drains and by placing them at wider intervals over the land, the cost of draining could be further reduced ; but, before this could be done, we must train our laborers to work with ordinary drain tools made, in size and weight, to suit their strength.

122. Of course, the fact that we have in this country to deal with conditions widely different to those met with in Europe must not be lost sight of; it is quite possible that the European system may prove unsuited to encounter the peculiar difficulties that may be met with in India. There is not room for a single doubt regarding the benefits the country will gain from its retentive soils being subsoil drained, but a difficulty may be experienced in devising a system of drainage specially suited to meet difficulties which may be encountered, such, for instance, as the closing of the pipes by white ants; the effects of a sudden fall of say 5 inches of rain in 24 hours, after an interval of say three months, in which not a drop of rain fell, &c.

123. Both of the plots were under maize and cotton last season; the crops were very good, seeing that, before being drained, the land was perfectly useless. Elsewhere will be found full particulars regarding these crops.

124. Plot (*a*) has not been successfully drained; the discharge of water after heavy rain was never very great, but lately it has been exceedingly small; there is evidently a stoppage somewhere. I fear that the openings in the soil which appeared in all parts of the field during the long drought, admitted the fine surface-dust amongst the stones during heavy rains; this dust forms on the surface of our arable soils during a drought, and from its extreme fineness it is easily conveyed away by water. Of course, when the water filters down through the soil, as it should do, this dust can never reach the drains; but the deep fissures I have before alluded to afford it a free passage. As long as the drains work properly, this would do but little injury; but immediately a stoppage occurs, it forms a dense mass with the broken stones that form the drain, and most effectually stop the passage of water. In Europe it has been found that thorough subsoil drainage at once puts an end to this periodical cracking of the soil, and it may prove to be so in this country when the drains have been longer in operation; but so far they have not proved effectual in this direction. By frequently cultivating and stirring the soil we can do a great deal to prevent the appearance of these fissures, but the system of drainage to be adopted in this country must be more perfect than to depend for success on the surface-soil being kept thoroughly tilled. Further experiments in draining with broken stones must be made before any conclusion can be formed. Though in the experiment I have made the cost of draining with stones is exceedingly high, it must not be forgotten that the whole of the expenditure incurred was for labor, and that while many ryots have not the means with which to purchase drain pipes, they can in most cases afford the labor needed for draining with stones.

125. The drainage of plot (*b*) has been most successful. The discharge of water is very great after heavy rains; during the monsoon, the flow for several days was as great as the pipe could discharge, and I have every reason to believe that up to the present time the action of the pipes continues quite perfect.

126. As far as can be judged from the short time these drainage experiments have been in operation, I consider that pipes will be far better suited than stones for use in draining, in this country. An important advantage attending the use of pipes is that land so drained can, during a drought, readily be subsoil irrigated by passing the irrigation water into them, sluices being put in the drains at suitable places to prevent the water passing out. By subsoil irrigation the water can be far more evenly distributed; no surface ground is required for water channels and there is less waste by evaporation. By thus combining drainage with irrigation, the agriculturist will be less dependent on the character of the seasons than at present.

Implements, Machines, &c.

127.—*The Double Mhote.*—Though the general results noticed in detail in my last report obtained in our experiments with this water-lift were most satisfactory, I thought that we might effect a still further improvement by substituting zinc buckets for the iron buckets with leather discharging tubes usually employed, and which so frequently needed repair; and the Overseer of the Experimental Farm having directed my attention to a model of a water-lift that he had con-

structed, in which zinc buckets were used on guide-rods that appeared to work in a satisfactory way, I determined to erect a double mhote at a well where a water-lift was needed, and to provide it with zinc buckets on the arrangements shown in the model, the fixed part of the machine was similar in construction to that of the double mhote noticed in my last report, excepting that only one horizontal beam resting on two pillars, with a short beam also resting on a pillar, were used instead of two long beams and four pillars, thus effecting a small saving in the cost of the machine. The buckets used were made of sheet zinc, strengthened by a light framework of iron ; on this framework, on either side, at about half the height, were placed iron rings which worked on the guides ; the bottoms of these buckets were perforated, and these holes were covered by a leather valve, which opened as the buckets began to descend into the water, and closed immediately they began to ascend ; the ropes were attached to handles made of rod iron, bent over on each side of the bucket and fixed on pivots, each bucket measured 2 feet 6 inches in height and 5 feet inches in circumference and brought to the surface on the average 36 gallons of water at each ascent. Each bucket worked on a pair of guide-rods made of round iron ; the lower ends of these rods were fixed in stones sunk in the bed of the well, their upper ends being fixed in the masonry of the discharging cistern, the rods were quite perpendicular from the bottom of the well up to the surface of the ground, when they gradually began to curve towards the cistern ; by this arrangement the buckets were made to empty their contents. At first it was found that the rods used were far too slight ; they vibrated so much during the ascent of the buckets, sometimes to such an extent as to arrest their progress, causing a severe strain on the working parts of the machine, this gradually became worse, until at length we had no choice but to remove the light rods and replace them by rods of a much greater diameter. When worked steadily, the machine gave most satisfactory results, raising in a day at least 50 per cent. more water than the first double mhote we erected, but the heavy rods though ¾ inch in diameter still vibrated very severely whenever the speed of the bullock was irregular. The machine was so severely strained whenever the buckets were checked in their ascent, frequent repairs became necessary, and as these were exceedingly troublesome in delaying work, and as I could see no way of rendering the rods more rigid, unless I incurred a considerable expense, I was obliged most reluctantly to abandon this arrangement for raising water, and to go back to the method described in my last report. If it had been possible to secure a steady working power, the arrangement would have answered admirably, but the slightest neglect on the part of the driver frequently caused an entire stoppage of the machinery. Had the water been nearer the surface of the ground, the vibrations in the rods would not, I think, have caused any inconvenience ; in the case noticed the water had to be raised 20 feet. If the rods could be stayed from the sides of the well they could be rendered quite rigid, but in this case the guide-rings could not be used, it would of course be possible, instead of the rings, to use a horse-shoe guide, which would not be arrested in passing up or down by the stays, but even with this it would be necessary to drive the cattle with great care or the guides would be thrown off the rods.

128. *Bullock-Gears.*—The bullock-gears in use for driving the water-elevators on the Experimental Farm have been considerably improved during the past year ; this improvement is in the method of attaching the cattle. Under the old arrangement, the two bullocks employed in working the elevator were separately yoked at opposite ends of a long pole, which was placed horizontally over the parapet wall across the centre of the well, and was supported and fixed in the middle to a head resting on the upright shaft of the driving wheel ; this pole projected about 4 feet on either side of the well, the ends being about 2 feet higher than the level of the bullock path, to these ends swingle-trees were attached, to which the bullocks were yoked by means of chains, connected with their collars. When engaged in raising water the cattle travelled around the well, and as there was always the well between them, it was exceedingly difficult to keep them going at a regular pace, when only one driver was employed ; when the driver was behind one bullock, the one on the other side took its ease, and when it received the attention of the driver the other in its turn slackened its pace, thus an irregular jerky motion was produced in the water-lift,

causing much injury to the working parts, and lessening the amount of work performed. A seat was placed for the driver over the centre of the well on the horizontal pole which rotated as the animals travelled around, but this seat was much disliked by the driver, and I think not without good reason, while when so seated he was not more successful than when on foot ; the fact is the cattle of this country are trained to work with their driver behind them, and it is exceedingly difficult to get them to work in any other way. Under these circumstances I determined to try what could be done to admit of the driver being always near both bullocks, as it would have been much too costly to employ two men. The head for the straight shaft was removed and in its place a V-shaped head was used, its narrow end was turned inwards and rested on the upright spindle of the driving wheel, in each of the arms of the head an horizontal shaft was fixed, these projected over the bullock path, the distance between these shafts at their outer ends was about seven feet ; upright bullock yokes were attached to these shafts, under which the cattle walked, the height of the bullock path having been cut down sufficiently low to admit of this being done, a syphon placed under the path serving to keep up the height of the water discharged by the lift. By this arrangement one bullock walks close behind the other, both being under the control of the driver, thus a larger amount of work is performed and the machinery is worked steadily.

129. *Straw-Burning Engines.*—The improvements recently made in steam engines, whereby they are enabled to burn such fuel as straw, indigo stalks, the stems and branches of cotton plants, &c., will admit of steam being used as a motive power in this Presidency to a much larger extent than seemed possible only a couple of years ago. The districts in which only steam culture seemed pracaticble were almost quite without fuel suited for raising steam in Portable Engines, but, in these districts, after the cotton harvest, there is in the cotton plants a plentiful supply of fuel suited for the requirements of Straw-Burning Engines. Straw cannot be used alone for raising steam in ordinary engines, its combustion is so irregular. We cannot, in Southern India, afford to burn any straw that is fitted for the use of live stock ; but there is in most parts of the Presidency a plentiful supply of materials, the refuse of the crops, suitable for use in these engines, that possess no value as food for stock.

SYDAPET MODEL FARM.

130. *The Sydapet Model Farm.*—Before reviewing the results obtained from the working of this farm during the past year, I would, in order that the the nature and present condition of the experiment may be fairly understood, direct attention to the following extracts from my report for the year ending 31st of March 1871, showing the circumstances under which the farm was started:—

" 238. The northern portion of the estate which, since the Committee (since abolished) took charge of the property, has always been rented by small tenants, was, in the early part of July last, set apart for the purposes of a Model Farm."

" 239. The condition of the land was very unsatisfactory ; the greater portion was overgrown with weeds and bushes, and a very considerable area had been appropriated by the public. Not only was the appearance of the land very discreditable ; but, owing to the great amount of trespass it caused, it was a nuisance to the neighbouring Experimental Farm."

" 240. At no time had the rents been regularly paid ; but it had become very difficult to collect even a very small proportion. It was in vain that large remissions had been made ; the renters were men of very small means, and several were without any agricultural training."

" 241. Most of them held under a five-years' lease, two years of which were unexpired. During the early part of last year several of them petitioned to be allowed to relinquish their land : but it was not until the month of July, when a general petition was received from all the tenants, that, seeing no other chance of bettering matters, it was determined to write off all arrears, and to take the land into our own management.

"253. Attempts have evidently been made, at different times, to bring portions under cultivation ; many of these attempts had been made in injudiciously-selected places, the result

was a broken surface on which it was scarcely possible to find a block of five acres fit for immediate cultivation..... "

"242. The total area thus set apart for a Model Farm is 115 acres; of this area seven acres is occupied by the nullah, roads, buildings, &c....."

"243. Nearly thirty acres can be irrigated, twenty acres from the Mambalam tank by gravitation and the remainder from the wells by picottahs, &c....."

"244. The dry soils differ greatly; about thirty acres is a blowing sand of the lowest type, about forty acres is a sandy loam of fair quality, free and easy to work, but in a very impoverished state; the remainder is a stiffish loam with a good deal of clay in its composition and a considerable amount of the red oxide of iron."

"245. To put the undertaking on a thoroughly commercial footing, it was determined to fix the rent at the average yearly income of the previous four years, and to deduct the annual value of the fruit trees which had to be removed to facilitate the work of reclamation."

"246. The average income of these four years was found to be Rupees 535."

"9. It was necessary, in order that the land should be thoroughly reclaimed and put into a good cultivatable condition, that a large number of indifferent mango and guava trees should be cut down. These were chiefly old trees which would not continue to bear much longer, though for a season or two they would be worth 150 Rupees per annum. Deducting this sum from the average annual income from the land, there remains a balance of 385 Rupees, and this sum will be the yearly rent to be recovered from the Model Farm. The timber and jungle clearings realized 2,721 Rupees; this was carried to the credit of the estate....."

131. It will be gathered from these extracts that the rent of the land selected for this Farm was fixed without any regard to the condition of the land or the quality of the soils. The fact that it had been abandoned by the persons who had previously rented it did not receive sufficient attention at the time the rent was fixed. It seemed perfectly fair to adopt as the rent to be paid by the Farm the average annual income derived from the land during the previous four years, but a sufficient allowance should have been made to compensate for the broken surface of the land, and for the worn-out and exhausted state of the soils.

132. Up to the present time the sum expended in bringing this land into cultivation is about Rupees 2,300, and it is probable that before the whole of the land is brought into a good cultivatable condition the entire expenditure will reach something near 5,000 Rupees. From its commencement, besides paying a full rent, the Farm has been debited with a charge at the rate of 7½ per cent. on every Rupee expended on works of reclamation and improvement, the sums paid on this account being as follows:—

	RS.	A.	P.
1870-71	94	6	7
1871-72	296	1	8
1872-73	328	1	6
1873-74	328	1	6
Total...	1,046	11	3

But this also includes interest on the capital expended in erecting buildings, which amounts to about Rupees 2,000; this, at 7½ per cent. for 3½ years, represents Rupees 525, which sum taken from Rupees 1,046-11-3 leaves Rupees 521-11-3 as the sum paid in the shape of interest on the money expended in reclaiming the land from its dilapidated condition &c. It seems to me now, scarcely fair to have called upon the Farm to pay this amount in addition to the full rent, for the rent charged *but just represents the value of the land after reclamation.* In proof of this I quote below an extract from the Classification Register of the southern portion of the estate, which land was taken up to form the Experimental Farm, and which, at the time it was classified and valued, was almost as well suited for being immediately brought under regular cultivation as

is the Model Farm land, after so much money has been expended in reducing its surface to a state fit for being brought under regular cultivation.

Classification Register of that part of the Model Farm (Experimental Farm) that as been already laid out in fields.

No.	Irrigated or dry.	Source of irrigation.	Description of soil.	Taram.	Rate per acre.	Area.	Assessment
					RS. A.	ACRES. CENTS.	RS. A.
1*a*.	Dry	Government well.	Permanently improved...2 1	1	4 8	0 25	1 2
...*b*.	Do.	.....	Black sand...5 1	5	1 8	4 21	6 5
2	Do.	.....	Do. ...5 2	6	1 4	15 51	19 6
3	Do.	.. ...	Red loam ...7 2	5	1 8	6 66	10 0
4	Do.	.....	Do. ...7 2	5	1 8	1 94	2 15
5	Peramboke...	.....	.....	...	.....	0 67	.....
6	Dry	Government well.	Permanently improved...2 1	1	4 8	0 68	3 1
7	Do.	.....	Black loam...4 2	4	2 0	0 75	1 8
8	Do.	Government well.	Red loam ...7 1	4	2 0	8 63	17 4
9	Do.	.....	Do. ...7 1	4	2 0	5 21	10 7
10	Peramboke...	.....	.....	...	.....	5 18	.....
11	Dry	Government well.	Permanently improved...2 1	1	4 8	3 90	17 9
12	Do.	.....	Red loam ...7 1	4	2 0	4 11	8 4
13	Do.	.....	Do. ...7 1	4	2 0	3 93	7 14
14	Do.	.....	Black sand...5 2	6	1 4	3 99	5 0
15	Do.	.....	Do. ...5 2	6	1 4	11 96	14 15
16	Do.	.....	Black loam...4 2	4	2 0	5 59	11 3
17	Do.	.....	Do. ...4 2	4	2 0	4 43	8 14
18	Do.	.....	Black sand...5 2	6	1 4	7 19	9 0
19	Do.	.....	Do. ...5 2	6	1 4	12 14	15 3
20	Do.	.....	Red sand ...8 2	6	1 4	2 61	3 4
21	Do.	.....	Do. ...8 2	6	1 4	1 47	1 13
22	Do.	.....	Do. ...8 2	6	1 4	3 34	4 3
23	Do.	Government well.	Do. ...8 2	6	1 4	5 1	6 4
24	Do.	.....	Do. ...8 2	6	.....	3 79	4 12
25	Peramboke...	.....	.....	...	.....	9 42	.....
					Total...	132 57	190 2

Abstract exhibiting the area and assessment of each class of soil

Taram or class.	Rate per acre.	Area.		Assessment.	
	RS. AS.	ACRES.	CENTS.	RS.	AS.
1	4 8	4	83	21	12
4	2 0	32	65	65	6
5	1 8	12	81	19	4
6	1 4	67	1	83	12
Total...		117	30	190	2
Peramboke...		15	27	.....	
Grand total...		132	57	.....	

(Signed) R. K. PUCKLE,
Deputy Director, Revenue Settlement.

(133.) After the completion of the improvements now in progress, the soils of this Farm may be roughly classified and valued as below:—

					Annual rent. RS.	A.	P.
20 Acres under tank* irrigation	at	Rupees	10	per acre ...	200	0	0
10 Acres under well irrigation	at	,,	5	per acre ...	50	0	0
40 Acres of dry land	at	,,	2	per acre ...	80	0	0
30 Acres of dry land	at	,,	1¼	per acre ...	37	8	0
8 Acres of dry land	at	,,	3	per acre ...	24	0	0
7 Acres under roads, &c.					...	...	..
111					391	8	0

134. But before the land is brought into this condition, the total expenditure incurred, as before noticed, will not be less than Rupees 5,000, which sum, at 7½ per cent., will represent an annual charge of Rupees 375 in addition to the rent, making the gross rental Rupees 760, or about *twice the amount at which the rent would have been fixed by the Settlement Department;* and in addition to this the farm pays 7½ per cent. on capital invested in buildings, and 5 per cent. on its working capital; the last two items are fair, but I certainly think that the farm *should be relieved of all charges on behalf of expenditure in levelling the land, &c.*, as these improvements directly add to the value of the property, and should not in justice be made at the expense of the occupying tenant.

135. On first starting the Model Farm, being so anxious that it should be debited with every charge that could in reason be placed against it, I unfortunately went too far in this direction, and burdened the farm with charges which, I am now convinced, should not have been debited against it. Thus, while the farm has been struggling with difficulties and showing an unsatisfactory balance sheet from having to meet these charges, the value of the property has been gradually increasing. In short, the tenant has been sacrificed for the good of the landlord. For if the estate was put into the market to-morrow, it would bring at the least Rs. 5,000 in excess of the price paid for it, and when the farm was begun timber and clearings to the value of Rupees 2,700 were sold, and the proceeds paid over to the landlord.

136. At the close of the year under review there was a debit against the farm amounting to Rupees 1,674-0-9, that is, after paying the full rent interest at 7½ per cent. on capital sunk in permanent improvements, interest at 5 per cent. on working capital, and every other charge since the farm was begun; the result of last year's operations is as follows :—

The expenditure —	RS.	A.	P.
Rent and interest	913	1	6
Overseer's salary	610	0	0
Labor	1,317	1	11
Cattle	105	0	0
Pigs	67	0	0
Sheep	35	8	3
Poultry, rabbits, &c.	45	2	0
Implements, machines, and tools...	67	5	0
Seeds	122	13	5
Cattle food	531	15	1
Manure	41	7	7
Sundries	16	10	2
	3,873	0	11
Income—			
Advance from General Funds	1,522	13	8
Cattle	419	7	5
Sheep	188	10	9
Pigs	390	11	6
Poultry, rabbits, &c.	65	2	10
Fruits, plantain, and vegetables	290	1	11
Fodder, &c.	238	11	3
Grains	411	5	7
Indigo and cotton	232	12	6
Sundries	113	3	6
	3,873	0	11

* During 5 months only in the year.

The balance sheet on the 31st March 1874.

LIABILITIES.	RS.	A.	P.
Loan from General Funds for 1870-71	2,776	9	10
Do. do. for 1871-72	1,310	3	11
Do. do. for 1872-73	1,772	2	2
Do. do. for 1873-74	1,522	13	8
Laborers' pay due for March 1874	155	5	3
Total Liabilities...	7,537	2	10

ASSETS.

	RS.	A.	P.	RS.	A.	P.
Cattle.						
16 Working cattle	1,200	0	0			
5 Feeding cattle	75	0	0			
Sheep.						
26 Ewes, 4 Wethers, 23 Lambs	260	0	0			
Pigs.						
5 Boars, 7 Sows, 4 Geldings	450	0	0			
Poultry	75	0	0			
				2,060	0	0
Implements.						
Implements, tools, carts, &c., as catalogued ...	...	...	...	760	1	6
Manures.						
200 Cart-loads of alluvial earth	30	0	0			
130 Do. of fold-yard manure	97	0	0			
43 Cart-loads of sulphate of lime and ashes ...	10	0	0			
¼ Cost of manure purchased in 1872-73... ...	30	3	7			
¼ Cost of cake purchased in 1872-73	126	8	11			
½ Cost of manure purchased in 1873-74... ...	20	11	9			
½ Cost of cake purchased in 1873-74... ...	265	15	6			
4,500 Pounds of straw	20	0	0			
				600	7	9
Fruit Trees, &c.						
Cocoanut and Mango trees, Casuarina trees, Guava trees	762	0	0			
Fruit Crops.						
Gauva, &c.	350	0	0			
				1,112	0	0
Field Crops.						
Grain and pulse crops...	80	0	0			
Guinea grass	150	0	0			
Fodder crops of sorts	250	0	0			
				480	0	0
Cattle Food.						
338 Pounds of oil cake	5	0	0			
15,000 Pounds of cholum straw	70	0	0			
Seeds, &c., in Granary.						
1,242 Pounds of car paddy	20	11	2			
874 Do. of sumba paddy	17	7	8			
25 Do. of indigo seed	2	0	0			
20 Do. of yellow cholum	0	8	0			
Sundries	199	8	0			
Cultivation done for next season's crop ...	100	0	0			
Uncollected bills...	435	6	0			
				850	8	10
Deficiency	...	...	...	1,674	0	9
				7,537	2	10

137. The return obtained from most of the best land was greatly lessened by the bad physical condition of the soil, produced by the flooding of the river Adyar; not only were several successive sowings destroyed, but the land from the absence of drainage became water-logged and yielded little more than half a crop. I am convinced that, unless this land, subject to being flooded, is thoroughly subsoil drained, it will never return a reasonable profit under high cultivation.

138. Under low farming, when little is spent on manure, &c., &c., there is but little to lose when adverse circumstances are encountered. High farming demands a large expenditure on labor, manure, &c., and the loss is proportionately great when unpropitious conditions are met with; hence before high farming can be successfully practiced, the conditions with which it has to deal must be somewhat under control, and therefore irrigation and drainage are essential to success where floods and droughts occur periodically.

139. Unfortunately the Model Farm is but ill-provided with irrigation water, and it is altogether without drainage of any kind. During the cropping season, between September and the end of November, all the low-lying land is frequently submerged by the overflow of the river which frequently results in the entire destruction of the paddy under which this ground is cropped, rendering it necessary to replant as late as December, which crops are not matured until April, by which time the irrigation water from the Tank has ceased to flow; if we can subsoil drain these low-lying lands, the ill-effects of the floods would be much less serious, as the drains would soon carry off the excess of water, and we would be able to harvest our crops in December, and thus not only be able to secure good crops, but we would have the further advantage of taking a second crop off the land before the irrigation source failed for the season.

140. The following statement shows the income and expenditure of the farm from its commencement :—

Income up to and including 31st of March 1874.

Items.	1870-71.			1871-72.			1872-73.			1873-74.			Total.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cattle...	403	1	9	560	14	9	371	15	0	419	7	5	1,755	6	11
Sheep...	...	...	...	141	10	6	237	2	6	188	10	9	567	7	9
Pigs	...	...	...	263	14	0	664	5	9	390	11	6	1,318	15	3
Poultry, rabbits, &c....	12	6	0	97	8	0	203	4	0	65	2	10	378	4	10
Fruits, plantains, and vegetables, &c. ...	474	12	6	582	10	3	444	1	6	290	1	11	1,791	10	2
Hay, green fodder, &c.	42	8	0	256	6	0	484	13	6	238	11	3	1,022	6	9
Grains.	407	0	10	705	9	3	178	11	2	411	5	7	1,702	10	10
Indigo and cotton ...	...	...	...	...	...	...	...	...	...	232	12	6	232	12	6
Sundries	101	10	3	228	4	0	301	9	10	113	3	6	744	11	7
Total...	1,441	7	4	2,836	12	9	2,885	15	3	2,350	3	3	9,514	6	7
Add the net valuation of the assets on the 31st of March 1874													5,707	12	10
Total...													15,222	3	5

* Half year.

Expenditure up to and including 31st of March 1874.

Items.	*1870-71.	1871-72.	1872-73.	1873-74.	——	Total.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Cooly labor	1,105 4 2	1,375 9 11	1,369 14 0	1,317 1 11	5,167 14 0	
Manure	8 0 0	71 1 4	185 2 7	41 7 7	300 11 6	
Live stock	1,641 15 0	731 6 8	636 8 0	252 10 3	3,262 2 11	
Food for live stock	267 11 9	557 7 8	506 3 11	531 15 1	1,863 6 0	
Seeds, trees, &c.	194 1 7	91 6 7	153 9 2	122 13 5	561 14 9	
Implements, tools, &c.	461 9 0	18 13 0	277 8 6	67 5 0	825 3 6	
Contingencies	74 4 9	100 2 3	16 6 9	16 10 2	207 7 11	12,188 12 7
Overseer's salary	113 12 0	370 0 0	600 0 0	610 0 0	1,693 12 0	
Rent	192 8 0	385 0 0	385 0 0	385 0 0	1,347 8 0	
Interest on capital employed in working the Farm.	69 8 4	150 0 0	200 0 0	200 0 0	619 8 4	
Interest on capital expended on improvements of a permanent character	94 6 7	296 1 8	328 1 6	328 1 6	1,046 11 3	4,707 7 7
Total...	... ...	... ...	... ...	... ...	... ...	16,896 4 2

141. It will be noticed, from what I have said, that the information to be derived from this experiment is *the cost of reclaiming and restoring land that has been exhausted under native farming*, rather than *the commercial results that can be secured by adopting a better system of agriculture;* to open a farm on virgin land and bring it into cultivation, is widely differen t.

IMPLEMENT WORKSHOPS.

142. During the past year Rupees 2,363-1-8 were received for implements, machines, &c., sold, and for labor and materials supplied by these workshops; and the expenditure on their behalf was Rupees 2,149-7-3.

143. The balance against these workshops from their commencement up to the 31st of March 1874 is Rupees 540-0-4, which sum includes interest on capital and every other charge. There should be no deficiency, as the prices charged are fixed to cover the cost of materials, coals, labor, interest on the capital employed, &c.; but during the past year the prices of iron and coals have fluctuated so greatly it has been difficult to adjust our charges to provide for these fluctuations, and it is exceedingly difficult in a small undertaking such as this is to keep accurate accounts, especially when much repairing work has to be executed; we cannot yet afford to employ a foreman in these workshops who would be able to keep accounts, and we have therefore to make up our charges for work, &c., from the rough memorandum kept by the workmen themselves. The Overseer of the Experimental Farm has charge of the workshops, but he can give them but very little personal attention, as his duties on the farm afford him full employment. A large amount of repairs are done for both farms, and it is very probable that all these charges have not been credited in the workshop account, especially for the work performed during the three months that Overseer Young was engaged in connection with the Agricultural Exhibition.

144. The debit against these workshops at the close of the year is but an insignificant sum, in comparison with the sum that would represent the advantages the Sydapet Farms enjoy from these workshops.

145. The recent appointment of an Assistant to aid me will enable me to put the accounts on a better footing, and make the workshops generally more efficient.

146. These workshops supplied during the year three improved carts, nine iron and combined ploughs, one iron cultivator, two sets of iron harrows, forty-two improved grass knives, several working models of ploughs, water-lifts, &c., a number of tools, and did a large amount of work for the Sydapet Farms.

* Half year.

147. The following are the details of income and expenditure during the past year :—

Income.

	RS.	A.	P.
Machines	834	10	9
Materials, labor&c., ...	1,528	6	11
	2,363	1	8

Expenditure.

Plant	4	5	0
Cooly labor, &c.	1,158	2	10
Materials, &c....	986	15	5
	2,149	7	3

Implement Workshops balance sheet for the year ending 31st of March 1874.

Liabilities.

	RS.	A.	P.
Advance from General Funds for 1870-71	883	1	5
Do. do. for 1871-72	213	1	2
Do. do. for 1872-73	1,077	3	2
Laborers' pay due for March 1874	88	13	3
Outstanding bills	95	0	0
	2,357	3	0
Deduct capital returned by sale of machines, &c., during 1873-74.	213	10	5
	2,143	8	7

Assets.

Buildings...	419	15	3
Plant	314	5	6
Materials...	197	7	1
New implements, machines, &c., in stock	412	4	0
Outstanding bills	259	8	5
Deficiency	540	0	4
	2,143	8	7

148. *Establishment.*—The work of this Department having far outgrown the capabilities of any one person, two Assistant Superintendents have been appointed ; one is a German and the other is an Englishman ; the former, Mr. Kaspar Schiffmayer, received his agricultural training in the Bavarian High School of Agriculture and at the University of Munich ; the latter, Mr. Charles Benson, is a graduate of the Royal Agricultural College, England. Both of these gentlemen have arrived in Madras and have entered upon their duties ; however, they must have a few months experience in this country before their services can be fully utilized. The general conduct of the Overseers and Clerks was satisfactory ; the Apprentices with one or two exceptions conducted themselves in a satisfactory manner.

SYDAPET, (Signed) WILLIAM R. ROBERTSON, M.R.A.C.,
31*st March* 1875. *Superintendent of Government Farms.*

* Since the commencement of the Workshops.

APPENDICES.

Rain-fall registered at the Experimental Farm during the year ending 31st March 1874.

April 1873.	May 1873.	June 1873.	July 1873.	August 1873.	September 1873.	October 1873.	November 1873.	December 1873.	January 1874.	February 1874.	March 1874.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1	1	1 ... 0·14	1	1 ... 0·95	1	1	1 ... 6·15	1	1	1 ... ...
2	2	2	2 ... 0·35	2 ... 0·07	2	2 ... 0·05	2	2 ... 2·31	2	2	2 ... ...
3 ... 0·53	3	3 ... 0·12	3 ... 0·07	3	3 ... 0·23	3 ... 1·10	3	3 ... 1·86	3	3	3 ... ...
4 ... 1·67	4	4	4	4 ... 0·46	4	4 ... 1·28	4	4 ... 0·08	4	4	4 ... ...
5	5	5	5	5	5	5 ... 0·81	5	5	5	5	5 ... ...
6	6	6	6	6	6	6 ... 0·80	6	6	6	6	6 ... ...
7	7	7	7	7	7	7 ... 0·06	7	7	7	7	7 ... ...
8	8	8	8	8	8	8	8	8	8	8	8 ... ...
9	9	9 ... 0·36	9	9	9	9 ... 1·40	9	9	9	9	9 ... ...
10 ... 0·18	10	10	10	10	10	10 ... 0·68	10	10	10	10	10 ... ...
11	11	11	11	11	11	11 ... 0·03	11	11	11	11	11 ... ...
12	12	12 ... 0·20	12	12	12	12 ... 1·03	12 ... 0·52	12	12	12	12 ... ...
13	13	13	13	13	13	13 ... 1·02	13 ... 0·20	13	13	13	13 ... ...
14	14	14	14 ... 0·04	14	14	14 ... 0·56	14 ... 0·93	14	14	14	14 ... ...
15	15	15	15	15	15	15 ... 0·60	15 ... 0·08	15	15	15	15 ... ...
16	16	16 ... 0·46	16 ... 0·10	16	16	16	16	16	16	16	16 ... ...
17	17	17	17 ... 0·05	17	17	17	17 ... 0·51	17	17	17	17 ... ...
18	18	18	18	18	18 ... 1·25	18 ... 0·22	18	18 ... 0·50	18	18	18 ... ...
19	19	19	19	19 ... 0·19	19	19	19	19	19	19	19 ... ...
20	20	20 ... 0·17	20	20	20 ... 0·35	20 ... 0·17	20	20	20	20	20 ... ...
21	21	21	21	21	21	21	21 ... 0·85	21	21	21	21 ... ...
22	22	22	22	22 ... 0.55	22 ... 0·90	22	22 ... 1·60	22	22	22	22 ... ...
23	23	23	23 ... 0·46	23 ... 0·30	23 ... 3·34	23 ... 1·14	23 ... 0·35	23	23	23	23 ... ...
24	24	24	24 ... 0·14	24	24	24	24	24	24	24	24 ... ...
25	25	25 ... 0·37	25	25 ... 1·42	25	25	25 ... 0·77	25	25	25	25 ... ...
26	26	26	26 ... 0·15	26	26	26	26 ... 0·67	26	26	26	26 ... ...
27	27	27	27	27	27 ... 0·22	27 ... 0·27	27 ... 0·59	27	27	27	27 ... ...
28	28	28	28	28	28	28	28 ... 0·59	28	28	28	28 ... ...
29	29	29	29	29 ... 0·17	29	29	29 ... 0·90	29	29		29 ... ...
30	30	30	30	30	30	30 ... 1·08	30 ... 0·35	30	30		30 ... ...
	31		31	31		31		31	31		31 ... ...
Total ... 2·38	Total. None.	Total... 1·68	Total... 1·50	Total ... 3·16	Total ... 7·24	Total... 12·30	Total ... 8·91	Total... 10·90	Total... None.	Total... None.	Total. None.

Government Farms' Expenditure.

	RS.	A.	P.	RS.	A.	P.
I. *General Supervision.*						
Establishment, including Superintendent's horse allowance ...	9,981	11	9			
Travelling allowance	...	...	...			
Contingencies	313	12	6			
				10,295	8	3
II. *Madras Experimental Farm.*						
Establishment	918	13	9			
Labor	3,008	10	6			
Implements and machines	882	12	8			
Live stock	297	2	6			
Seeds	195	9	6			
Food for live stock	1,519	1	0			
Manure	542	15	7			
Despatching seeds...	135	5	8			
Contingencies	229	7	5			
				7,729	14	7
III. *Madras Model Farm.*						
Establishment	610	0	0			
Cooly labor...	1,317	1	11			
Manure	41	7	7			
Live stock	252	10	3			
Food for live stock	531	15	1			
Seeds	122	13	5			
Implements, carts, and water-lifts	67	5	0			
Rents and interest	913	1	6			
Contingencies	16	10	2			
				3,873	0	11
IV. *Implement Workshops.*						
Blacksmiths, carpenters, and filer	875	9	1			
Cooly labor	282	9	9			
Implements, machines, and materials	991	4	5			
				2,149	7	3
V. *Educational.*						
District Farm Apprentices...	2,166	3	6			
Sydapet do. do.	1,330	6	9			
Schoolmaster for laborers' children	80	1	6			
Books for library	114	0	2			
House-rent, &c., to Assistant Superintendent	483	8	9			
Contingencies	225	5	5			
				4,399	10	1
VI. *Estate Improvements of a Permanent Character.*						
Repairs to buildings, water channels, &c.	1,712	3	0			
Repairs to roads	484	15	6			
Additions to out-houses of Farm bungalow	459	11	5			
Repairing and deepening wells	298	4	1			
Gate-houses and gates	1,023	10	8			
New roads	1,501	9	0			
Water channels	94	14	0			
Sub-soil and surface drainage	553	11	8			
Trees and planting	34	3	8			
Contingencies	14	12	0			
				6,177	15	0
Agricultural Exhibition net expenditure	...		...	8,890	3	1
Total ...				43,515	11	2

Government Farms' Receipts.

	RS.	A.	P.	RS.	A.	P.
I. *Madras Experimental Farm.*						
Fruits, vegetables, &c.	134	10	6			
Fodder, &c.	114	12	9			
Rent, &c.	1,166	9	0			
Cattle	105	0	0			
Sheep	78	11	2			
Pigs	128	14	6			
Poultry, rabbits, &c.	35	9	0			
Feeding-grains, seeds, and cattle-food	370	9	10			
Cotton, &c.	249	2	0			
Sundries	528	14	11			
				2,912	13	8
II. *Madras Model Farm.*						
Fruits, vegetables, &c.	290	1	11			
Fodder, &c.	238	11	3			
Cattle	419	7	5			
Sheep	188	10	9			
Pigs	390	11	6			
Poultry, rabbits, &c.	65	2	10			
Feeding-grains, seeds, and cattle-food	411	5	7			
Indigo	144	4	0			
Cotton	88	8	6			
Sundries	113	3	6			
				2,350	3	3
III. *Implement Workshops.*						
Machines, &c.	834	10	9			
Labor, materials, &c.	1,528	6	11			
				2,363	1	8
Total ...				7,626	2	7

Valuation of the Live and Dead Stock of the Experimental Farm on the 31st of March 1874.

	RS.	A.	P.	RS.	A.	P.
Cattle—						
3 Bulls	1,315	0	0			
21 Working cattle						
Sheep—						
38 Rams	934	0	0			
60 Ewes						
23 Gimmers						
44 Lambs						
Pigs—						
3 Boars	705	0	0			
20 Sows						
20 Young pigs						
Poultry	70	0	0			
				3,024	0	0
Manures.						
Guano, bones, and charcoal	...	...	...	385	0	0
Fold-yard and other manures						
Growing Crops.						
Fodder (of sorts)...	187	0	0			
Plantains, &c.	400	0	0			
Guinea grass	175	0	0			
Cotton	100	0	0			
Indigo	60	0	0			
Cocoanut and cashewnut trees	150	0	0			
				1,072	0	0

Farm Seeds, &c.

		RS.	A.	P.	RS.	A.	P.
595	lbs. of Pegu paddy	19	13	4			
475	„ of Goondoo Sumba paddy	9	8	0			
258	„ of Carolina paddy	8	9	7			
245	„ of Sumba paddy	4	14	5			
22½	„ of Red Pootoo paddy	1	0	0			
21	„ of Burmese paddy	1	0	0			
76½	„ of White Pootoo paddy	3	13	2			
65	„ of Car paddy	1	1	4			
616	„ of Yellow Cholum	15	6	5			
147	„ of Shamay	5	14	4			
62½	„ of Horse-gram	1	9	0			
9	„ of Linseed	1	2	0			
30	„ of Gingelly	1	12	10			
47	„ of Green Gram	2	2	2			
143½	„ of Sorghum Saccharatum	7	2	9			
66	„ of Caromony	3	0	0			
233	„ of Corkapilly seed	11	10	5			
140	„ of Caster-oil seed	4	6	5			
153	„ of Cotton in seed	13	8	0			
30	„ of White Oats	2	0	0			
283	„ of clean Cotton	65	14	8			
6,180	Maize Cobs	62	0	0			
234½	lbs. of Wool	21	15	9			
					269	4	7
	Cattle Food.						
3,519	lbs. of Ground-nut oil cake	...	...	...	47	8	1
	Implements.						
	Implements and tools as catalogued in Inventory*	...	...	...	5,027	5	0
	Total ...				9,825	1	8

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st of April 1874.

1 Set of steam ploughing and cultivating apparatus, tackle, windlass, porters, &c. by Messrs. Fowler and Co.
1 Chaff-cutter and universal mill, with bullock-power by Messrs. Ransomes and Sims.
1 Threshing machine, with a bullock-power, by Emery Brothers.
1 Threshing machine by Dray Taylor and Co.
1 Threshing machine, with bullock gear and carriage, by Ransomes and Sims.
1 Threshing machine, with a bullock gear and carriage, by Garret and Co.
2 Winnowing machines by Garret and Co.
1 Winnowing machine by Dray Taylor and Co.
1 Winnowing machine by Ransomes and Sims.
1 Winnowing machine by Hornsby and Sons.
3 Reaping machines by Samuelson and Co.
1 Drill sowing machine, 8 rows, by Garret and Co.
1 Cylindrical corn screw by Ransomes and Sims.
2 Ploughs by Ames and Co., Boston,
1 Turn-wrest plough and yoke by Ransomes and Sims.
1 Stone roller,
2 Drill sowing machines, 13 rows, by Garret and Co.
1 Wood drag-harrow by Experimental Farm.
2 Iron chain harrows.
1 Combined grubber.
4 Bullock hoes.
1 Bullock plough by Howard and Co.
1 Bullock plough by School of Arts.
2 Bullock ploughs by Mint.
2 Bullock ploughs by Ransomes and Sims.
1 Double mould board plough.
1 Large plough, with two wheels, by Ransomes and Sims.
1 Swing plough by Roorkee Workshop.
1 Wood swing-plough by Ransomes and Sims.
1 Wet land plough by Experimental Farm.
1 Wooden roller.
1 4-wheel waggon.
1 Stone trolley.

* Steam Engine transferred from Agricultural to Public Works Department.

1 Root-pulper by Ransomes and Sims.
2 Sets of iron harrows, with swingletree, by Ransomes and Sims.
3 Country carts.
1 Water cart.
1 Sewage cart, by Gun Carriage Works.
1 Maize sheller, by Ainsworth and Co.
1 Maize sheller, by Ransomes and Sims.
1 Drainpipe-making machine.
1 Corn drill.
1 Barrow drill, by Experimental Farm.
1 Rain gauge.
1 Water elevator, by Burges and Key.
1 Water elevator, by Mint.
1 Water elevator, by Experimental Farm.
1 English ladder.
1 Norton's tube-well with a rotary motion.
1 English grindstone.
1 Farm bell.
2 Wheel hand-hoes.
9 Cattle yokes.
2 Single bullock carts.
1 Overhead, bullock-power, with shafts and gearing.
1 Sugar-cane mill.
1 Californian pump.
1 Archimedian pump.
1 Cake-crusher.
1 2-wheel plough with cultivator, by Ransomes and Sims.
1 Pump, by Roorkee Workshop.
1 Chaff-cutter, manual-power.
1 Combined mill and oil-cake breaker, by Ransomes and Sims.
1 Chain pump, manual-power.
1 Chain pump, bullock-power.
1 Large platform weighing machine.
1 Large beam and scales.
1 Cotton gin, by Gordon and Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
1 Country cotton gin.
8 Cottage cotton gins.
2 Cotton gins, by Burges and Key.
1 Hand broad-cast sowing machine.
5 English carts.
1 Malabar spoon bale.
1 Waterproof cart cover.
1 Sack-barrow.
1 Portable scale with weights.
3 Picottah buckets.
2 Leather buckets with ropes and gearing for double mhote.
1 Large wheel-barrow.
14 Wheel-barrows.
3 Hay frames for carts.
1 Hand cart.
1 Subsoil plough.
2 Farm clocks.
5 Tables.
8 Chairs.
1 Writing desk.
5 Almirahs.
1 Iron cash chest.
2 Writing tables.
2 Book-shelves.
1 Dynamometer.
1 Surveying level with stand, staves, &c.
1 Set of bottle levels. Chemical Apparatus, Mortars and Pestles, Glass-breakers, &c.
29 Feeding tubs.
5 Metal feeding troughs.
1 Scythe.
1 Manure drag.
2 Bengal picks.
2 Dutch hoes.
10 Hoes.
10 Hand-hoes.
5 Forks of sorts.
2 Hand harrows.
7 Iron rakes.
32 Mamoties.
2 Hatchets.
1 Large field rake.
13 Crowbars.
16 Picks.
2 Mattocks.
2 Hedge shears.
3 Billhooks.
1 Iron real.
7 Grass knives.
4 Manure forks.
14 Digging forks.
1 Horse hoe.
6 Shovels.
4 Sets of bullock harness.
2 Surveying chains with pins.
2 Iron cisterns.
A quantity of wire rope, and a large number of details belonging to steam plough.
35 Specimen seed bottles.
2 Hedge knives.
3 Pairs of thorn pincers.
1 Spade.
1 Ear punch for marking sheep.
1 Mercal, one half-mercal, and one measure.
1 Weeding spud.
3 Pairs of sheep shears.
1 Pruning knife.
1 Dibble.
A number of spanners.
4 Mallets.
4 Rammers.
1 Poultry feeding-cage.
1 Maize cobstand.
2 Driving wheels.

1 Large rubbish screen.
1 Drain scoop.
1 Lactometer.
1 Levelling board.
1 Single-barrel fowling piece.
1 Pair of pan scales.
1 Branding iron for marking sheep.
1 Theodolite.
1 Sickle.
1 Chester measure metallic tape, 66 feet

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1st of April 1874.

2 Iron ploughs.
4 Combined ploughs.
1 Set of iron harrows with swingletree.
2 Country carts.
1 Box cart.
6 Reaping hooks.
6 Hand-hoes.
8 Picottah buckets.
1 Chopper.
20 Feeding tubs.
1 Levelling board.
2 Spades.
3 Small wheel-barrows.
1 Clock.
6 Digging forks.
7 Yokes.
8 Planters' hoes.
1 Tub for well.
1 Scythe.
1 Weeding spud.
1 Tarpaulin.
1 Measure.
1 Half-mercal.
1 Scale triangle, weights, &c.
1 Large beam and cattle-weighing scale.
9 Fifty-six pound weights.
15 Plough shares.
1 Table.
2 Hand-hoes.
1 Knife.
1 Hay fork.
1 Mamoty.
1 Pair pincers.
1 Turn-screw.
1 Chisel.
1 Gimlet.
1 Bell.
1 Water cask.

List of Tools, &c., belonging to the Implement Workshops on the 1st of April 1874.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
18 Tongs.
3 Bellows.
2 Screw plates.
4 Sledge hammers.
6 Small hammers.
6 Chisels, " Smith's."
8 Punches.
1 Countersinking punch.
4 Dies or flat chisels.
2 Pairs calipers.
1 Iron square.
2 Round files.
4 Half-round files.
3 Flat files.
21 Taps for screw plates.
1 Iron brace and five bits.
1 Filer's hammer.
1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
1 Square file.
1 Angular file.
1 Bob drill and taps.
2 Screw liners.
1 Bench with 2 vices.
3 Hand saws.
1 Pit saw.
1 Cross cut saw.
7 Augers.
2 Jack planes.
1 Spoke shove.
1 Spirit level.
1 Shoeing rasp.
1 Pincer.
1 Compass.
6 Carpenter's chisels.
1 Cold chisel.
2 Set squares.
1 Angle square.
6 Gimlets.
1 Brace with 37 bits.
2 Adzes.
1 Hammer.
1 Turn-screw.
1 Plummet.
4 Saw files.
4 Rasps for wood.
1 Mallet.

List of Books added to the Apprentices' Library during the year 1873-74.

Transactions of the Agricultural and Horticultural Society of India, 8 Volumes, 1829, 1836, 1837, 1837, 1838, 1839, 1840, and 1841.
Leaves from the Book of Nature, by M. S. DiVere, 1856.
Instructions for the use and application of Pyrimont Seyssel Asphalte, 1860.
Rudimentary Treatise on Clay Lands and Loamy Soils, by Professor Donaldson, 1852.
Rudimentary Treatise on Mineralogy, by D'Varley, 1849.
Rudimentary Treatise on the Drainage of Districts and Lands, by G. D. Dempsey, C.E., 1849.
Bingley's Elements of Useful Knowledge, by Rev. William Bingley, A.M., 2 Vols., 1831.
Lardner's Cabinet Cyclopœdia on Heat, by Dr. Lardner, 1833.
Odling's Practical Chemistry, by William Odling, M.B., F.C.S., 1854.
Illustrated Geology, by F. C. Bakewell, 1856.
Botanist's Companion, by Professor Balfour, 1860.
Letheby on Food, 1872.
New Farmer's Almanac, by John C. Morton, 1866.
Do. do. do. 1868.
The Practical Sugar Planter, by Leonard Wray, Esq., 1848.
Elementary Chemistry.
Elements of Geometry, by Commissioners of National Education in Ireland, 1857.
Hints to Horsekeepers, by Henry William Herbert.
Allen's Rural Architecture, by Lewis F. Allen.
Boussingault's Rural Economy, by J. B. Boussingault.
Caldwell's Agricultural Chemical Analysis, by G. C. Caldwell.
The Forest Tree Culturist, by Andrew S. Fuller.
Milch Cows, by M. Francis Guenon.
Tobacco Culture, by 14 Experienced Cultivators.
Turner's Cotton Planters' Manual, by J. A. Turner.
The Carpenters' and Joiners' Handbook, by H. W. Holly, 1872.
The Mule, by Harvey Riley, 1869.
The Young Farmer's Manual, by S. Edward Todd, 2 Volumes, 1870.
Hop Culture, by 10 Experienced Cultivators.
Familiar Letters on Chemistry, by Justus von Leibig, 1859.
Elements of Agricultural Chemistry, by Thomas Anderson, M.D., 1860.
Principles of Agricultural Chemistry, by Justus von Leibig.
The Principles of Agriculture, by William Bland.
Scientific Farming, Made Easy, by Thomas C. Fletcher, 1861.
Chemistry in its relation to Physiology and Medicine, by George E. Day, M.A., &c.
Johnston's Experimental Agriculture, by James F. W. Johnston, M.A., &c., 1859.
The Sheep, by W. C. L. Martin, 1862.
The Pig, by W. C. L. Martin, 1860.
Pneumatics, by Charles Tomlinson, 1858.
Rudimentary Mechanics, by Charles Tomlinson, 1858.
Rudimentary Treatise on Well-digging, Boring, &c., by J. G. Swindell, 1852.
Rudimentary Treatise on Blasting and Quarrying of Stone, by Major-General Sir John Burgoyne, K.C.B., 1849.
Art of Constructing and Repairing Roads, by Henry Law, C.E., 1855.
How to observe "Geology," by H. T. DeBeche, F.R.S., 1836.
Horsekeepers' Guide, by James Mills, M.V.C.S.
Act No. I. of 1871, English.
Papers relating to Tea Cultivation in Assam, 1861.
Selections from the Records of the Madras Government, No. 23, Reports on the Fibres of Southern India, 1856.
Report upon the Present Condition and Future Prospects of Tea Cultivation in the North-West Provinces, 1860.
An Essay on the Culture and Manufacture of Indigo, by John Shortt, M.D., 1862.
Journal—Amusement for idle hours, and hints for the improvement of the resources of India.
The Earth, Plants, and Man, by Joachim Frederic Schoun, 1859.

Manual of Technical Analysis, by Bolley and Paul, 1857.
First Lessons in Geology, by Gideon Algernon, by Mantell, L.L.D., F.R.S., 2 Volumes.
Orr's Circle of Sciences, Elementary Chemistry, by John Scoffern, M.B., 1855.
Orr's Circle of Sciences, Geology, Mineralogy, and Crystallography, by Professor D. T. Austed and Professor Tennant, F.G.S., 1855.
Principles of Comparative Physiology, by Dr. Carpenter.
American Agriculturist, 1869—71.
The Illustrated Farmers and Gardeners' Almanac, 1873.
Orr's Circle of Sciences.
The Journal of Agriculture, January to June 1868.
Report on Caoutchouc, by James Collins, 1872.
Cotton—An account of its Culture in the Bombay Presidency, by Walter R. Cassels, 1862. .
Collectors' Reports on the System of Agriculture followed by Ryots in the several districts of the Madras Presidency.
Madras Revenue Administration Report for 1870-71.
Do. do. for 1871-72.
Do. do. for 1872-73.
The Journal of the Royal Agricultural Society of England, Vol. VIII., Part II., 1872.
Do. do. do. Vol. IX., Part I., 1873.
Mantell's Medals of Creation, by Gideon Algernon Mantell, L.L.D., F.R.S., &c., Vol. I., 1853.
Do. do. do. Vol. II., 1853.
Report on the production of Tobacco in India, by J. E. O'Connor, 1873.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY),

FOR THE YEAR ENDING 31ST OF MARCH 1875.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT GAZETTE PRESS.
1875.

CONTENTS.

	Paras.
GENERAL—	
Season, &c.	1 to 4
Office-work	5 and 6
Agricultural Apprentices	7 to 10
Permanent Improvements on the Sydapet Farm Estate	11 and 12
Concrete	13 to 17
Snakes, &c., killed on the Sydapet Farm Estate	18
Agriculture in the Madras Presidency	19 to 31
Swamp irrigation and the drainage of rice lands	32 to 35
Arable land rendered barren by an accumulation of salt on its surface	36 to 58
Market prices	59 to 62
SYDAPET EXPERIMENTAL FARM—	
Cattle	63 to 70
Sheep	71 to 75
Pigs	76 to 79
Poultry	80 to 83
Field experiments	84 and 85
Seed-sowing	86 and 87
Carolina rice	88 to 93
Wheat	94
Maize	95
Yellow cholum	96 and 97
Jute	98 to 102
Roselle	103
Sunn hemp	104 and 105
Guinea grass	106 to 110
Casuarina trees	111
Loss to agriculture from the practice of using cattle dung as fuel	112 to 123
Ferns as manure	124 and 125
Lime	126 to 128
Sub-soil draining	129 to 133
New implements and machines	134 to 141
SYDAPET MODEL FARM	142 to 153
IMPLEMENT WORKSHOPS	154 to 157
ESTABLISHMENT	158

APPENDIX.

1. Rain-fall of the year.
2. Government Farms' Expenditure.
3. Valuation of Live and Dead Stock belonging to the Experimental Farm.
4. Seeds distributed gratuitously.
5. Implements, Carts, Machines, &c., belonging to the Experimental Farm.
6. Do. do. do. do. to the Model Farm.
7. Tools, &c., belonging to the Implement Workshops.
8. Catalogue of Books added to the Library during the year.

THE ANNUAL REPORT OF THE SUPERINTENDENT OF GOVERNMENT FARMS, FOR THE YEAR ENDING 31ST OF MARCH 1875.

GENERAL.

SEASON, &c.

1. *Weather.*—The rainfall registered at the Sydapet Experimental Farm during the past year amounted to 68·98 inches, against 47·23 inches, the average annual fall of the previous ten years. The amount of rain that fell would have been quite sufficient for the requirements of agriculture, had it been more evenly distributed throughout the year, but it was chiefly precipitated in heavy showers at very irregular intervals; though the fall was much higher than the average annual fall, there were only fifty-nine wet days, against seventy-three, the average number of wet days in each year during the previous ten years; thus, on the average, there was 1·17 inches of rain registered for each day on which rain fell.

2. There was no rain whatever in April. There were three wet days in May, and during these three days the fall was 6·79 inches, giving an average of 2·26 inches for each wet day. In June the rainfall was 6·66 inches, which fell on seven days; the average fall on each day was ·95 inches. In July there were eight wet days, and the quantity of rain registered was 5·46 inches, giving ·68 inches as the fall for each day. During the next month the rainfall was much lighter, only 2·34 inches precipitated on five days, giving an average of ·47 inches for each day on which rain fell. September was an unusually wet month; there were twelve days on which rain fell, while the quantity collected was 10·59 inches, or more than double the average fall in this month, during the ten previous years. The total fall in October was 21·91 inches precipitated on ten days, an average of 2·19 inches per wet day; though the fall was so heavy, there was only one day previous to the 16th of the month on which rain fell, and there were only three wet days on which the quantity of rain registered was less than one inch, while on the 23rd, 24th, and 25th the total amount collected was no less than 13·94 inches. The rainfall registered in November was only about half the quantity usually registered in this month; there were seven wet days and the fall amounted to 9·25 inches, or 1·32 inches per day. Rain fell only on five days in December, during which 5·11 inches were collected, giving an average of 1·02 inches for each day. During the remaining three months of the year the quantity of rain collected was only ·87 of an inch, which fell on two days.

3. The following table shows the amount of rain that was registered during each month of the year, and the number of days in each month on which rain fell, compared with the average monthly registrations of a similar kind for the preceding ten years:—

—	1874-75.		Average of the previous 10 years.	
	Inches.	Wet days.	Inches.	Wet days.
April	...	...	0·28	0·8
May	6·79	3	0·84	1·3
June	6·66	7	2·79	7·6
July	5·46	8	3 96	10·4
August	2·34	5	5·32	11·3
September	10·59	12	4·25	8·6
October	21·91	10	8 19	11·5
November	9·25.	7	14·14	13·4
December	5·11	5	5·39	6 0
January	0·10	1	1·08	1·4
February	...	..	0·91	0 9
March	0 77	1	0·08	0·4
Total ...	68·98	59	47·23	73·6

4. The next statement exhibits the rainfall of the year made out in weekly totals.

—	1874-75.		Average of the previous 10 years.		—	1874-75.		Average of the previous 10 years.	
	Inches.	Wet days	Inches.	Wet days		Inches.	Wet days.	Inches.	Wet days.
1st Week...	...	...	·22	·2	28th Week .	...	...	·80	1·7
2nd do. ...	...	...	·03	·2	29th do. ..	3·23	2	4·00	3·8
3rd do. ...	...	...	...	...	30th do. ...	17·53	7	1·22	2·8
4th do. ...	...	...	·04	·3	31st do. ...	...	...	1·73	2·2
5th do. ...	5·80	1	·76	·4	32nd do. ...	1·40	2	2·11	2·5
6th do. ...	·71	1	·01	·3	33rd do. ...	·10	1	2·26	3·1
7th do. ...	...	...	·04	·2	34th do. ...	·25	1	4·19	3·6
8th do. ...	·28	1	·03	·3	35th do. ...	7·50	3	5·33	3·8
9th do. ...	...	...	·14	·3	36th do. ...	...	...	3·50	2·4
10th do. ...	4·93	4	·68	1·1	37th do. ...	5·01	4	·62	1·3
11th do. ...	·42	1	1·20	2·3	38th do. ...	...	...	·36	·7
12th do. ...	...	...	·34	1·9	39th do. ...	·10	1	·19	1·0
13th do. ...	1·31	2	·44	2·1	40th do. ...	...	...	·03	·4
14th do. ...	·84	1	·20	1·3	41st do. ...	...	..	...	...
15th do. ...	1·58	3	1·26	2·5	42nd do. ...	...	...	·58	·6
16th do. ...	2·26	3	·76	3·1	43rd do. ...	·10	1	·47	·2
17th do. ...	·78	1	1·07	2·5	44th do. ...	...	...	...	...
18th do. ...	...	...	1·30	2·5	45th do. ...	...	...	·70	·6
19th do. ...	·99	3	1·54	2 8	46th do. ...	...	...	·02	·1
20th do. ...	1·10	1	·55	2·5	47th do. ...	...	...	·12	·1
21st do. ...	·25	1	1·38	2·1	48th do. ...	·77	1	·07	·1
22nd do. ...	2·55	1	1·36	2·7	49th do. ...	...	...	·08	·4
23rd do. ...	2·41	5	·66	2·2	50th do. ...	..	...	...	...
24th do. ...	2·82	2	·87	1·8	51st do. ..	...	...	...	...
25th do. ...	·50	1	1·54	2·4	52nd do. ...	...	...	...	...
26th do. ...	2·31	3	1·00	1·7					
27th do. ...	1·15	1	1·43	2·2	Total ...	68·98	59	47·23	73·3

Office-work.

5. The large amount of arrears of office-work, which had accumulated prior to the appointment of my Assistant, is rapidly being reduced. I trust to be able to overtake this work before next cold season, if I can remain at my Head-Quarters until then.

6. The following professional questions, which are a few selected from those put in the demi-official letters received by me during the past year, have been answered :—

Presidency, Province, or District from which the Questions came.	General Nature of Questions.
Tanjore	Asking what foods are best suited for use in fattening cattle and sheep.
Do.	Asking for advice regarding a course of reading on agriculture.
Mysore...	Asking for information regarding the cultivation of maize as a field crop.
Nilgiris	Asking for an explanation regarding the differences in the action of two mixtures of manures which had been applied to land planted with coffee.
Coimbatore District...	Asking opinion regarding the nutritive values of certain grasses.
Chingleput District ...	Asking for advice regarding the cultivation of Guinea grass.
Rajpootana.	Asking advice regarding the reclamation of soil covered by an efflorescence of salt.
Cuddapah District ...	Asking opinion regarding a proposal to introduce a steam plough into the district for general agricultural use.

Presidency, Province, or District from which the Questions came.	General Nature of Questions.
Ganjam	Asking for information regarding the cultivation and uses of *Sorghum Saccharatum*. Also for details of Carolina paddy cultivation.
Hyderabad	Asking for information regarding foods best suited for feeding dairy stock and for fattening cattle and sheep.
Tanjore	Asking for advice regarding the sub-soil drainage of swamp land.
Kistna District	Asking for advice regarding the adoption of improved methods of cultivation.
Travancore	Asking for advice as to the improved agricultural implements and tools best suited for the use of the ryot.
Coimbatore District...	Asking advice regarding the cultivation of plants with large fleshy roots.
Bombay	Asking for information regarding the cultivation of Carolina paddy.
Punjab...	Asking advice regarding a course of reading on agriculture.
Nilgiris	Asking advice regarding the feeding of stock on ground-nut cake.
Chingleput District...	Asking for advice regarding the cultivation of Casuarina trees.
Nilgiris	Asking for advice regarding reaping machines in view to the selection of one for cutting grass on the rough grass land of the district.
Wynaad	Asking opinion as to the action of lime on a soil, and the quantity to be applied to a soil under coffee cultivation.
Mysore	Asking advice as to the treatment of sheep newly imported from Europe.
Travancore	Asking for advice regarding the analysis of a soil.
Nilgiris	Asking advice regarding the selection of a chaff-cutter suited for the use of a planter.
Coimbatore	Opinion asked regarding the quality of a sample of tobacco and of wheat.
Wynaad	Asking advice regarding the selection of a chaff-cutter for use on a coffee estate where a large number of cattle are kept.
Cuddapah	Asking for information regarding the construction of a "double mhote" for raising water.
Trichinopoly	Asking for advice regarding the selection of a breed of sheep for introduction into the district.

Agricultural Apprentices.

7. In the Sydapet Farm Class there were at the close of the year six apprentices; the only change that took place in this class during the past year was the removal of one of the youths from the class, who had obtained employment as a Farm Overseer in Mysore, and the appointment of another youth to fill the vacancy his removal caused.

8. The District Farm Class at the close of the year consisted only of two apprentices, it having been thought unadvisable to fill up the vacancies that had occurred in this class, pending the receipt of the decision of Government regarding the whole question of agricultural education, which question had, for some time, been under consideration.

9. The District Farm class was examined in June last. The following are the results of that examination :—

———	Full Marks.	A.	B.	C.
Paper Examination.				
1. Mention what crops are growing in fields Nos. 8, 10, 13, 14, and 23 ?	5	4	4	5
2. Mention the hours during which the draught cattle are daily employed	5	5	5	5
3. What area of land, under a crop drilled 18 inches apart, can be hoed by a bullock hoe during an ordinary working day, the land being in good condition ?	5	...	...	...

———	Full Marks.	A.	B.	C.
PAPER EXAMINATION.—(*Concluded.*)				
4. On the Experimental Farm in what month are the ewes generally put to the ram? and in what month are most of the lambs born? also, in what month are the lambs usually weaned?	10	8	8	10
5. If a plough travels at the rate of 1½ miles an hour, turning a furrow slice 9 inches wide, what area of land will it plough during a working day of 8 hours, assuming that 25 per cent. of the time is lost in turning at the head-lands?	10	5	8	...
6. What is the average cost at present on the Model Farm of excavating a cubic yard of earth and carrying it a distance of 20 yards?	5	5	5	5
7. Mention the number of permanent (broad) incisor teeth and the number of temporary (milk) incisor teeth in the mouth of a three year old sheep	10	...	...	...
OUT-DOOR EXAMINATION.				
1. *Ground-nut Oil-cake.*—Recognise? Why is it used on the Sydapet Farms in preference to other kinds of feeding stuff? What quantity is given per head to each kind of stock? What price is paid for it per 100 lbs.?	10	9	9	3
2. *Seed Drill.*—Explain how it works when sowing, and how it can be altered to enable it to sow in lines with narrow or wide intervals between; and how the depth at which it sows is regulated?	5	5	5	5
3. *Winnowing Machine.*—Explain its construction and the uses of its various working parts	5	5	3	...
4. *Expanding Drag Harrow.*—Explain its uses, and mention the advantages possessed by such a harrow over one of the ordinary kind	5	3	5	2
5. *Bullock Hoe.*—Explain its construction and its uses	5	3	5	2
6. *Sheep.*—Point out in the flock a good specimen, and state in detail why the selection is made	5	4	4	3
7. *Poultry.*—What breeds of poultry have succeeded best on the Experimental Farm? In what respect do the birds of the breed now kept differ from ordinary country fowls?	5	4	4	1
8. *Mauritius Maize.*—Recognise variety? What quantity of seed per acre should be sown? How should the land be prepared for maize? When should maize be sown in this district? and when is the crop usually harvested?	10	8	8	6
Total ...	100	68	73	47

10. I have again and again, in my reports, drawn attention to the many imperfections of the system of training, under which the youths in the apprentice classes at Sydapet are supposed to gain a knowledge of agriculture, and have pointed out, more especially, the mistake of trusting entirely to field-training to qualify Hindoo youths as agriculturists; and I am glad that this view is now held by Government who, in a recent Order, sanctioned the abolition of these apprentice classes, and authorised instead the Establishment of a School of Agriculture in which youths of the class to which these apprentices belong, and others desiring to become agriculturists, may meet with facilities for gaining a thorough knowledge, both practical and theoretical, of agriculture.

Permanent Improvements on the Sydapet Farm Estate.

11. The services of one of my Assistants being available for employment, I thought it advisable to avail myself of the opportunity thus afforded me for carrying out, under competent superintendence, certain extensive works of improvement on this property, which, in most instances, had been allowed to stand over during a considerable period owing to my inability from pressure of work to undertake them.

12. Amongst other improvements undertaken were the following :—A new road, measuring nearly a mile in length, was opened on the eastern side of the estate ; this road connects the Model Farm roads with those on the Experimental Farm ; the portion that runs through the Model Farm is of great use in affording the means of gaining access to land which previously could not be reached by carts. The surface of nearly all the undulating sandy land on this property has been greatly altered and in many cases terraced ; this was done in view to prevent further injury to the soil during heavy rains, by inducing a larger proportion of the water that falls to pass down into the soil. I had at one time hoped that it would have been possible to have avoided undertaking this heavy work, but further experience proved that it was unwise to persist longer in the attempt to bring these sandy slopes into a good cultivatable condition by manure and cultivation alone. These soils, which contain on the average from 90 to 95 per cent. of sand, would retain nothing in the shape of manure during heavy rains, the manure being almost entirely washed out of the land and carried with a finer particles of the surface soil away down to lower levels. The surface of a considerable area of other land situated within the limits of the Model Farm was also greatly altered to enable the land to benefit by occasional irrigation from the Marmalong Tank, and by water to be brought by the new channel from the Chembrumbakum Tank. On the Model Farm a large amount of work was executed in re-forming the beds under which the wet land was divided, which was rendered necessary by the crooked, irregular boundaries of these beds interfering so greatly with the cultivation and with the irrigation and drainage of the land. On the same Farm a small plot of land, which was in a very swampy condition, was thoroughly sub-soil drained and rendered dry and healthy. A new boundary fence was constructed on the western side of the Experimental Farm. The necessary repairs were done to the various buildings on the estate. A number of Casuarina and other trees were planted over the property.

13. *Concrete.*—This material was largely used on the Sydapet Farms during the past year ; it was generally formed of the following ingredients :—One part of lime, five parts of broken bricks, and two parts of sand, prepared as follows : the lime having been thoroughly slacked and the bricks broken up to about the size of walnuts, they were, with the sand, thoroughly mixed together while dry, after which a quantity of water was thrown over the heap, and the whole thoroughly blended.

14. The concrete has proved especially efficacious when used for protecting the floor and sides of drains in which the fall was great. The outfall of a large open drain through which a great quantity of water occasionally passes was much improved last year by being coated with this concrete ; though built of large stones, it very frequently needed repairs ; various simple means had been tried to protect the slope from damage, but none were at all successful, and stone-in-lime would

have been too costly. This outfall was particularly well suited to test the value of concrete as a protection where the wash is great, as the water was discharged from a height about 10 feet above the level of the drain beneath, and in its descent passed over the concrete covered slope. The result of the experiment has been most satisfactory. On another part of the estate, the arch of a small bridge was made with concrete, and, though it has been frequently submerged by the river, it has stood remarkably well. For making water channels, the concrete has proved most useful. The following result shows the cost that was incurred for making 72 running yards of channel, the inside dimensions of which were, depth 8 inches, and width 8 inches, the walls and floor being 4 inches in thickness:—

	RS.	A.	P.
Breaking bricks—2 men, at 3 annas a day, and 13 women, at 2 annas per day	2	0	0
Refuse bricks and cart-hire	2	4	0
Mixing concrete and making drain—10½ coolies, at 3 annas per day ...	1	15	6
Lime for concrete—10 parahs, at 12 parahs. per Pagoda...	2	14	8
Lime for smooth coat—6 parahs, at 12 parahs per Pagoda	1	12	0
Bricklayers' hire for laying on smooth coat and finishing drain	3	7	0
Total ...	14	5	2
Per running yard	0	3	2

15. Concrete is a much cheaper material than brick-in-lime for many purposes in which the latter is employed, and its use ought to be much extended in this country where the bricks are generally so very inferior. A lime concrete, such as described, is not well suited for building walls above ground, for this purpose a cement concrete is generally used.

16. The following shows the cost at Sydapet of 100 cubic feet of concrete and of 100 cubic feet of brick built in lime:—

Concrete.	RS.	A.	P.
Refuse bricks and cart-hire...	2	4	0
Sand, 2 cart-loads	0	4	0
Lime, 7 parahs	2	0	8
Breaking 35 parahs of bricks	0	10	0
Bricklayers' hire for building 100 cubic feet of concrete, at 3 pies per cubic foot	1	9	0
Total ...	6	11	8
Cost per cubic foot	0	1	1
Brick-in-lime.			
2,000 bricks	6	0	0
10 parahs of lime	2	14	8
3 cart-loads sand	0	6	0
100 cubic feet of building, at 6 pies per cubic foot	3	2	0
Total ...	12	6	8
Cost per cubic foot	0	2	0

17. Concrete can be prepared from the refuse bricks of old buildings that are useless for any other purpose, road-making excepted ; the more they are broken and covered by old mortar, the better they are suited for use in this way. Concrete will be of great value for many agricultural purposes in this country, and there is in most localities an abundance of material in the shape of old walls, tumble-down buildings, &c., the removal of which would considerably improve the appearance of many of our towns and villages.

SNAKES, &c., KILLED.

18. The following statement shows the number of snakes, rats, and squirrels killed on the Sydapet Farm Estate for which rewards were paid during the past year :—

Cobras	24
Other snakes	139
Squirrels and rats	532

A much larger number of snakes were killed in the previous year, and I hope that the small number killed last year may be taken as evidence that we are succeeding in killing down these dangerous pests, for there were peculiar facilities last year for killing snakes, as from the long drought the fields were bare during a much longer period than is usual, and I believe that the coolies are now as ready as ever they were to earn the small rewards given for killing snakes. There were no deaths during the past year amongst Farm coolies from snake-bite, but amongst the Farm live-stock there were several deaths that were attributed to this cause.

AGRICULTURE IN THE MADRAS PRESIDENCY.

19. The following facts throw some light on the real condition of agriculture in this Presidency, regarding which such opposite opinions are held :—

20. (*a*) *Small proportion of the area of the Presidency now utilized.*—The entire area of the Presidency comprises 138,318 square miles, or 88½ millions of acres ; of this, 50,623 square miles consist of permanently assessed properties, Government forests, and hill tracts, leaving 87,695 square miles, or 56,124,800 acres directly under Government. Of this 56 millions of acres, only 27⅛ millions of acres are under occupation ; there is thus nearly 30 millions of acres of Government land altogether unutilized.

21. (*b*) *Small revenue received from the land in the shape of rent.*—The total area under occupation last year was 27,360,000 acres, and the total rent collected was 34,933,583 rupees, which is only Rupees 1-4-5, or about 2*s*. 4*d*. per acre.

22. (*c*) *Low value of the produce of an acre of cultivated land. Dry land.*—During the last official year there were 13,895,331 acres under dry cultivation in the Madras Presidency (excluding South Canara and Malabar, for which I have no figures) that paid rent, amounting to 15,009,850 rupees, an average of Rupees 1-1-3, or about 2*s*. per acre. With these figures it is very easy to ascertain the average value of the produce of an acre of dry land by means of the formula used in fixing the rent in this Presidency, which is as follows :—From the money value of the estimated outturn, a deduction of one-quarter is made as an allowance for unfavorable seasons ; and from this remainder, the cultivation expenses are deducted, and thus the net value of the crop is ascertained, half of which forms the Government rent. Thus it is only necessary, in order to arrive at the net value of an average crop, to multiply by 2 the sum received as rent for one acre, which is Rupees 2-2-6, or 4*s*. To the amount thus obtained, we must add the cultivation expenses which are said by the Settlement Department to average about Rupees 4-10-3. By adding this sum to the net value of the produce already determined, we get Rupees 6-12-9 per acre ; to which if we add the one-fourth deducted to provide for unfavorable seasons, we will ascertain the average value of the produce raised on one acre of land under dry cultivation in this Presidency, which is Rupees 8-7-11, or about 15*s*. 7*d*. excluding the value of the straw, which is taken as a set-off against the keep of the cattle which forms no charge in the cultivation expenses. *Wet land*—It is not quite so easy to arrive at the average value of the produce of an acre of land under irrigation. There were last year in the Madras Presidency (again excluding South Canara and Malabar) 3,105,622 acres under wet cultivation, for which, in the shape of rent, 16,873,137 rupees were received, which is Rupees 5-6-11, or about 10*s*. per acre. To ascertain the average value of the produce on one acre of this land, we must proceed in the same way as we did in determining the value of the produce of dry land ; thus, twice the amount of the rent represents the net value of the produce which is Rs. 10-13-10,

to this we add the cultivation expenses, which are said by the Settlement Department to average about Rupees 7-9-9 per acre, which, added to the net value of the produce, makes Rupees 18-7-7 per acre. In fixing the rent of wet land, the deduction made for unfavorable seasons is only One-sixth ; this, added to the figures previously obtained, brings up the total to Rupees 21-8-10, about two pounds sterling as the average value of the produce of an acre of irrigated land, less the value of the straw, which, for the reasons stated when referring to dry crops, is omitted in the calculation.

23. (*d*) *Small incomes of the Cultivators.*—It is very easy to ascertain the amount of income enjoyed by Cultivators in this Presidency, if the information contained in the previous paragraph is accurate ; thus it is only necessary to deduct the annual rent from the value of the produce of an acre of land, and the balance that remains is the income of the Cultivator and his family for their joint labors. If we take for illustration the renter of a holding of 12 acres, 10 acres of dry land, and 2 acres under irrigation, the annual income derived therefrom will be as follows :—

	RS.	A.	P.
10 acres of dry land, the produce of which is valued at Rupees 8-7-11 per acre	84	15	2
2 acres of wet land, the produce of which is valued at Rupees 21-8-10 per acre	43	1	8
	128	0	10
Deduct rent, 10 acres of dry land, at Rupees 1-1-3 per acre, and 2 acres of wet land, at Rupees 5-6-11 per acre	21	10	4
	106	6	6

From this it would appear that the total income derived from a 12 acre holding to repay the Ryot for the labor of himself and family, and expenses incurred in cultivation throughout a year would be in a favorable year only Rupees 106-6-6, and in an average year, deducting the one-, fourth allowed for bad seasons, only Rupees 79-12-11, or about Rupees 6-8-0 per mensem equal to three shillings per week.

24. (*e*) *Large proportion of occupied land under fallow.*—Of the 27,360,000 acres under occupation, 4,996,000 acres were last year under bare fallow, produced no crop whatever, and paid no rent.

25. (*f*) *Low type of crops generally grown and the small area under crops that need manure and moderately good cultivation.*—Of the 22,364,000 acres under crops, food grains occupied 18,385,000 acres, of which 26,000 acres only consisted of wheat ; this crop is perhaps not so well suited for cultivation in the southern half of the Presidency, as it is for culture in the northern half ; but even in the districts peculiarly suited for its cultivation, it occupies but a miserable proportion of the land under food grains ; thus :—

District.	* Total Area under Food Grains.	Of which Wheat occupies.
		ACRES.
Salem	1,432,000	1,000
Nilgiris	34,000	3,000
Coimbatore	2,089,000	3,000
Kurnool	1,700,000	8,000
Bellary	2,909,000	6,000
Cuddapah	1,527,000	3,000
Kistna	1,657,000	2,000

* Includes some land twice charged, being cultivated with 2 crops during the year.

The area under wheat might be very largely increased especially in the districts to which I have just referred. Wheat requires moderately good cultivation with a fair allowance of manure; taking this into account in connection with the certainty that there is in this country a good market for wheat at renumerative prices, the miserable position it occupies in the cropping of the Presidency is, I think, conclusive evidence of the low condition of the agricultural practice pursued. Again sugarcane is another crop which requires manure and moderately good cultivation, and this occupied but 36,000 acres of the 22½ millions of acres under crop last year, and it grows well nearly in all parts of the Presidency.

26. (*g*) *The entire absence of any fodder or root crops raised for the food of stock.*—There is no crop especially grown for feeding stock which in any way resembles the fodder, roots, and other restorative crops of more civilized countries. Nearly every acre of the 22½ millions of acres was occupied by what is termed in agriculture an exhausting crop. As I have before pointed out, crops that need the liberal supply of manure are almost unrepresented in the cropping of this Presidency.

27. (*h*) *Low commercial value of the agricultural produce of Southern India.*—In the English Market, Madras cotton is generally from 25 to 50 per cent. less in price than American cotton; Madras rice is only about half the value of American rice; Madras tobacco will scarcely command a sale, excepting for the manufacture of sheep washes. Indigo, coffee, and tea command good prices, but then these are produced under European management.

28. (*i*) *Poverty of the arable soils of the Presidency.*—In the absence of analyses of the different arable soils of the Presidency it is exceedingly difficult to produce proof of their poverty in plant food, as the small crops obtained may be the result of inferior cultivation rather than due to the poverty of the soil. Though I am unable to produce evidence as conclusive as I should desire, I am able, from the results of the investigations made by Mr. Broughton regarding the quality of country tobacco, to produce some facts which throw a great deal of light upon the matter. Mr. Broughton determined only the quantity of carbonate of potash in the ash of the tobaccos he examined, however, the quantity of this mineral in the ash of the tobacco plant bears a very close relation to the quantity in the soil that produced the tobacco, and therefore the information gathered by Mr. Broughton possesses considerable value as indicative of the quantity of potash in the arable soils of the Presidency. The following are the results:—

Districts in which Tobacco was produced.	Number of Analysis.	Average per cent. of Carbonate of Potash in Ash.
Vizagapatam	7	9·76
Trichinopoly	6	6·01
Bellary	4	6.22
Nellore	2	6·96
Cuddapah	12	4·39
Tanjore	1	8·71
North Arcot	5	4·58
South Arcot	3	11·29
Nilgiris	2	17·81
Kurnool	5	5·73
Coimbatore	13	7·68
Kistna	10	13·52
South Canara	1	5·6
Madras	5	·70
Chingleput	2	·63
Madura	15	7·02
Salem	4	8·05

For comparison I give below a statement showing the quantity of potash in a few samples of tobacco produced in other countries :—

	Per cent.
Maryland tobacco	40·7
Do. do.	47·4
Massachusetts do.	47·8
Hungarian do.	26·46

Professor Emil Wolff of the Royal Academy of Agriculture, Wirtemberg, publishes seven analyses of tobacco, the ashes of which contained on the average 27·4 per cent. of potash, and one sample of which contained as much as 54 per cent. There is a very marked difference between the quantity of potash in the ash of tobacco raised in this Presidency, and, in other countries due, I think, entirely to the different quantity of potash in the soil.

29. To show what an important part potash plays in the food of plants, I would direct attention to the following, showing the quantity of potash in the ash of some of our more important agricultural products :—

	Per cent.
Potatoes	59·8
Turnips	39·3
Lucerne	25·3
Cotton lint	41·20
Cotton seed	35·44
Wheat	31·1
Barley	21·9
Maize	27·0
Paddy	18·4
Cholum	11·9

The deficiency of potash in the arable soils on which tobacco is grown, which are always more highly cultivated and manured than any other soil under crops, is, I think, strong evidence that our soils are gradually becoming exhausted.

30. The yield of the soils is also worth considering ; thus, while in Madras, the Ryot is contented to get 70 or 80 pounds of clean cotton per acre, the American Farmer is not contented unless he gets from 450 to 500 pounds per acre. The same with rice ; an average crop of paddy in this Presidency is about 15 bushels per acre ; in America, 70 bushels is no unusual crop. In Madras a maize crop of 10 bushels per acre is a good one ; in America crops of this grain vary from 50 to 80 bushels, and sometimes even amount to 100 bushels per acre.

31. (*j*) *The inferiority of the agricultural live-stock of the Presidency.*—The inferiority of our live-stock, with some slight exceptions, is so universally admitted that I need only mention this fact as another evidence in proof of the low condition of our agriculture.

Swamp Irrigation, &c.

32. I should be extremely sorry if any observations I have made in former reports, deprecatory of the irrigation practice of our Ryots, should be, in any way, accepted as antagonistic to irrigation, for no one can more highly appreciate the benefits that arise from the proper use of irrigation water than I do. It was the abuse of irrigation to which my condemnatory observations applied ; the almost universal practice in this country being to swamp the land instead of to irrigate it. It is exceedingly difficult to ascertain with any degree of accuracy the quantity of water that a Ryot would be contented to use in the cultivation of an acre of paddy ; he appears to think that he cannot use too much when the only trouble he is put to is to open a sluice. The following extract from a note by the Acting Chief Engineer for Irrigation on a report of an irrigation experiment made in the Godavery District in 1872 throws some light on the subject :—

4. The actual quantities of water supplied per hour per acre, both artificially and by rain, are noted in the margin ; water was first supplied on the 5th of May for the preparation of the seed-beds, and the last supply was obtained on the 20th of November. It is not stated when the crop was transplanted, but probably late in June or early in July, and hence the average supply during the season must have been about 4·87 cubic yards per hour per acre—a quantity which is known to be far above what is required." In the report on the experiment, it is stated as follows :—" 3. The Cultivator was allowed to take water as he wished, but was looked after by a Lock Superintendent who lives near the spot, and a Delta Superintendent who frequently visited it, and they were supposed to see that he did not wilfully waste the water. The water could not be passed on to other cultivation." Here we have an instance of a sheet of water, an acre in extent, and 9 feet deep, used in addition to a rainfall of 26 inches, to bring to maturity one acre of paddy, and this, under the superintendence of Irrigation Officers, whose presence undoubtedly contributed to lessen the quantity of water that would otherwise have been used. I have no reason to suppose that this Ryot was more greedy in the use of the water than are other Ryots, who are equally favorably circumstanced for getting a supply. The quantity used in other irrigation experiments, made by the Public Works Department, varied from 6 feet to 7 feet in depth in addition to the rainfall to mature a crop of paddy. My experience proves that under moderately good cultivation, with a soil of fair average quality, a volume of water, one acre in extent, and about 4 feet in depth, would be ample for the production of one acre of paddy. Not only does swamp irrigation cause an enormous waste of a valuable producing power, but it is highly prejudicial in many other ways ; the health of the people is injured ; the soil is rendered unfit for cultivation, except under semi-aquatic crops of low types ; and the capabilities of our irrigation works are seriously lessened by the smaller area thus watered. The following extract from a report on irrigation as practiced in Spain by Mr. Clements Markham is well worth consideration in connection with the subject on which I am now writing :—

	C. Yards.
From 5th May	·81
,, June	1·57
,, July	4·29
,, August	3 59
,, September	3 07
,, October	7·32
To 20th November	6 09

" The cultivation of rice around the shores of the Albufera was introduced by the Arabs, and was prohibited on account of its unhealthiness and the waste of water it occasioned, by King Martin of Aragon in 1403 A.D. Permissions and prohibitions have alternated since that time, and Cavanilles recommended the total discontinuance of a cultivation which produced so many fevers and such swarms of mosquitoes. Attempts have been made near Valencia to grow rice without irrigation, but they were fruitless.

" It would certainly appear that, apart from its extreme unhealthiness, the cultivation of rice in this country is open to serious objections. The continuous harvests and incessant swamping wear out and enervate the land, and now the use of guano and other manures is essential. The rice is sown in April and May, and reaped in September, so that the swampy land is seldom exposed to the influence of heat, and the stagnant water keeps it in a constant state of saturation, and rapidly neutralizes its fertilizing properties. At present the cultivation of rice is very strictly prohibited beyond certain prescribed limits, and the use of guano as manure is believed to have decreased the pernicious effects of the swamped land, though in what way it is difficult to understand."

33. Indigenous paddy from long cultivation as a semi-aquatic crop has become peculiarly adapted for swamp culture, especially in the formation of its roots, which consist of a net-work of horizontal fibres, particularly well suited to support the plant on semi-liquid mud, and it is for this very reason that the plant is not suited immediately for drier cultivation, for, directly the soil is allowed to become at all dry, these surface roots are scorched by the sun and the plant withers ; nevertheless, it can be cultivated successfully with a much less quantity of water than is

now frequently used ; but for cultivation on wet land with a less expenditure of irrigation water, it would be better to select a variety of paddy the roots of which have a greater tendency to go down into the soil.

34. Though it may be true that the Indian Ryot seldom or never thinks of providing means for the removal of the excessive quantity of water he pours on his land during the cultivation of paddy, the Cultivators of this grain in other countries are not so neglectful; in the aggricultural newspapers, published in the Southern States of America, I frequently meet with with inquiries addressed to the Editors, asking for advice regarding the treatment of paddy land. One correspondent, writing to the Editor of the Southern Cultivator, which is published in Georgia, in February 1874, writes as follows :—

"I write at the request of a friend who plants a thousand acres of rice, **** the ditches run from bank to bank at itervals of 30 feet, cut 3 feet deep, leading into side drains which are parallel with the embankments, cut 4 feet deep by 5 feet in width, emptying into a canal 6 feet deep by 30 feet clear water-way. You will see from this that the drainage is as thorough as practicable." The Editor, in reply, recommends still further attention to drainage. Another correspondent, an old South Carolina Rice Planter, in a letter to the "Rural South Land," published in New Orleans, in February 7th of last year, says :—

"Our rice planters should bear in mind the fact that, in order to obtain the best results, their rice lands must be thoroughly drained." And as regards Spain, Mr. Markham, in the report before alluded to, says :—

"One of the most important parts of the Murcian irrigation system is that which provides for the drainage of surplus water. The sub-soil is a stiff tenacious clay, and arrangements for preventing the accumulation of stagnant water and the formation of swampy ground are particularly urgent. The irrigating channels flowing from the right bank of the *Azequia Aljufia* terminate at the river, but those from the left bank are led down the valley, and have no natural outlet for their surplus water. Very deep trenches, called *azarbes*, are, therefore, dug in the lower part of the garden of Murcia, which receive, not only the unused water of the channels, but also the drainage of the irrigated land."

35. It is frequently remarked by persons, who ought to know better, "that, if the Indian Ryot knows but little regarding dry-land cultivation, he has nothing to learn regarding wet-land culture." This is, I think, a most serious mistake, for, as far as my experience goes, the cultivation of wet land in this country is but little, if at all, superior to the cultivation of dry land. To produce an average crop on a good soil, with the aid of an abundant supply of water, is no test of the quality of the farming practiced ; the question is whether this good soil could not, with half the quantity of water generally used, be made to produce as good results ; and in this way double the area under irrigation, at the same time improve the sanitary condition of the country and maintain the productive powers of the soil over a longer period.

Treatment of Salt Lands.

36. I have had but little personal experience in the treatment of land rendered barren by an excess of salt. There were on the Sydapet Experimental Farm two or three plots of very limited areas, on which, in dry weather, there was a light covering of salt, caused evidently by the absence of sub-soil drainage, the plots in each instance being surrounded on two sides by water, the ordinary level of which was only a few inches below the surface of the land. I tried various means to get rid of this excess of salt, but none were quite successful. Amongst the means tried were dressings of different mineral manures, such as carbonate of lime, sulphate of lime, ashes, &c., deep ploughing, frequent surface washings by fresh water, and dressings of sand and of farm-yard manure. Of these, the last mentioned produced the best results. I tried various crops on the land, which were known to be salt-feeders, but in no instance did I succeed in

obtaining a fair covering of plants, or in bringing any to maturity. I have had many opportunities for ascertaining the conditions under which, in this Presidency, salt generally appears on arable soils. From the Kistna District, in which large areas of land have been injured from this cause, I received from the late Mr. Boswell, the Collector, much valuable information and a large assortment of samples of the different soils so injured. From this and other information I have collected, I am strongly inclined to believe that the only effectual way of curing permanently the land so injured is to drain it thoroughly by means of sub-soil drains. The following information may, however, prove interesting and in some cases be of use. It refers to the method adopted by the Ryots of the Coimbatore District in treating land rendered unfertile by an excess of salt. The information was collected by the Tahsildars of the district, and was kindly placed at my disposal by the Collector, Mr. Wedderburn.

37. *Coimbatore Tahsildar's Report.*—"Salt lands are first levelled and subdivided into plots by banks one-and-half feet high. The plots are then manured by the plants peranday, milk-hedge, kolanji, yerukalay, auvaray, púngay, and other plants and creepers, and these plants are trod into the mire as well as excreta of cattle, &c. If these plots are occasionally watered for twenty days, the plants will not have a bad smell and mix with the earth. The salt is taken off by the fermentation which these plants produce. This method should be practised twice a year, and that for three years."

38. "There is another mode of improving salt lands. The skins of several kinds are soaked in water till they have a bad stench. This water with hairs, &c., is applied to the plots which are watered again. After a period of about ten days this water is drained off and the land is again watered."

39. "But the salt will come up again in lands improved thus if there is excessive rainfall in the proper season of the year."

40. "The rich Ryots will practise these methods often and often and keep their land free from salt. But the poor Ryots are unable to manure their land so often; their land once improved again gets impregnated with salt."

41. *Suttimungalum Tahsildar's Report.*—"The lands are first ploughed and watered, then the following plants, &c., are applied to them to take off the salt, *i.e.*, kolinji, auvaray, yerukalay, peranday, púngay, prickly-pear, silt sand, and dust. This method the cultivators practise for two or three years. In some places prickly-pear is raised in the salt land and left to grow for four or five years, after which the plants are cut and the land ploughed and cultivated. In the same manner aloes are planted on such lands and allowed to stand for three or four years. These two plants, the cultivators say, eat off the salt from the lands."

42. *Collegal Tahsildar's Report.*—"To improve the salt lands which have best soil half or one foot below the surface, the Ryots, after well ploughing the lands, collect water in them, and after draining the water off they apply to them manure and plants, such as yerukalay and others. And when the lands have extracted all the juice of the plants, they cultivate them. But, if there is no good soil many feet below the surface, such lands are excavated to the depth of half a-yard and the pits so made are filled either by good soil or silt. These improvements are done to wet lands only. In case of punjah lands such a trouble is not for the most part taken. The lands of this kind are improved in course of years by manuring them with sweepings, ashes, and other manure."

43. *Perindooray Tahsildar's Report.*—"It appears that the cultivators apply to their salt lands the following plants, &c., to take off the salt from the land, *i.e.*, peranday, yerukalay, auvarary, kolinjy, leaves of púngay, milkhedge, and vélan bark after the arrack is extracted from it. They tread these plants into the land and plough it over and over again, and continue the method for two or three years. If the salt remains in the field after this improvement, they raise in the fields dams two or three feet high and collect the water in the fields; this they practise

in three or four years. If improved in this way, the salt no doubt goes away from the field. Expense for raising these dams is not great because they do this gradually."

44. *Caroor Tahsildar's Report.*—"To salt lands which are cultivated with wet crops the people apply, after they are watered and ploughed, the following plants, *i.e.*, peranday, aloes, thoombay, yerukalay, auvaray, milkhedge and leaves of pungay and peroomarum, and to garden lands they apply the ears of cumboo after taking the grains off in addition to the above-mentioned herbs."

45. These they put in their fields ploughed and watered, tread them in the mire, and keep the field in this state till the plants are rotten. If prepared thus, the salt will go out. In punjah (dry) lands dams are raised in the fields to collect water from the rain and then the water drained off together with the salt."

46. *Pollachy Tahsildar's Report.*—" On punjah (dry) salt lands the Cultivators apply the chaff of grains, sweepings, and other manure for three or four years, and these take off the salt from the land. If there be excess of rain, the lands thought to be freed from the salt will become unfit for cultivation. For wet lands they apply kolinjy, yerukalay, and peranday, after draining the land ploughed and prepared for the purpose. These plants are rotten and then get mixed with the mire. They again plough the field and apply to it the sweepings and stalks of raggy, &c. Thus the salt is taken off the lands. This process is carried on every year; one year's improvement is of no use."

47. *Palladum Tahsildar's Report.*—" The fields are first levelled to collect the water from rain, then the plants, aloes, kolinjy, yerukalay, and milkhedge are mixed with the mire. Afterwards the fields are divided into plots as the wet lands are and cultivated for two years with paddy. At times the silt of the beds of tanks is placed in the field. These, the Cultivators say, are the methods by which the salt is taken off the fields."

48. *Dharapuram Tahsildar's Report.*—" It seems that Cultivators manure their salt lands by the plants peranday, kolinjy, and aloes, and then plough it twice or thrice. Some people make their salt lands fit for cultivation by spreading over them to the height of a span the loose sand blown by wind."

49. " Another method of improving salt land is to apply wool to the land and plough it."

50. *Bhowany Tahsildar's Report.*—" The plants, yerukalay, auvaray, pungay, peranday, kolinjy, and parappoodoo (a plant supposed to grow on rocks) are applied to nunjah (wet) salt lands, which are then cultivated."

51. " In some places the people procure manure and sweepings at little or no expense, which they apply to their lands."

52. " The practice of using milkhedge to the fields does not exist in this district as the people are unable to get it in quantities required."

53. " Salt punjah (dry) land is manured by the dung of cattle, herds of which are for the purpose collected on the land."

54. " The practice of collecting water in the field after ploughing it during the rainy season does not exist in this part of the district. It seems that this method should be applied only to the lands which are sloping, but if applied to the flat land the salt will not go out."

55. " The people do not take so much care about their salt lands after the fall of rain, but go with their ploughs to their better lands."

56. " In some places salt lands of all kinds are cultivated with hemp or flax, and the people say that the leaves of these plants serve as manure. But this practice does not seem to be extensive."

57. *Udumulpettah Tahsildar's Report.*—"On inquiring of the wet land cultivators about the mode by which they improve their salt lands to be fit for cultivation, it appears that, after ploughing those lands, they annually apply to them the plants peranday, kolinjy, and auvaray in bundles, tread them into the mire, and keep the land in this state till those plants are rotten. Then they plough the lands and sow paddy in them, which yield a pretty good return as the salt does not come up; but this will not wholly free the land from salt."

58. The plants and leaves generally applied for improving the salt land are the following :—

Auvaray = Cassia Auriculata.
Kolinjy = Galega.
Yerukalay = Asclepias gigantia.
Peranday = Cissus quadrangularis.
Poonga = Dalbergia Arborea or Pongamia glabra.
Patchan or Kally = Milkhedge.
Thoombai = Phobius Indica.

(Signed) A. WEDDERBURN,
Collector.

Market Prices.

59. The entire absence of trustworthy information, regarding the current rates prevailing at one time in different parts of this Presidency, for agricultural productions, is a serious drawback to the prosperity of the country. At present prices are liable to great fluctuations; a rise of thirty per cent. and a fall of a similar amount are far from unusual, and frequently for no sufficient reason; but not only do the prices at any given market fluctuate greatly, but those prevailing at that market and at another market situated at no great distance differ almost as widely. Before the extension of railways, canals, and good roads over the country, great fluctuations in prices and wide differences in those ranging at one time in different localities were only to be expected; but, now that the facilities are so much greater for the conveyance of agricultural produce over the country, we might reasonably expect that the prices would be more uniform and less liable to sudden and great changes.

60. Great fluctuations in prices are beneficial neither to the farmer nor to the consumer of his produce; as a rule they seldom arise directly from natural causes, but spring from the machinations of speculative middlemen, who are the chief gainers by unsteadiness of prices. Ryots seldom keep any agricultural produce on hand for any length of time; their surplus grain they generally sell soon after it is harvested, when it is bought up by these speculators, who utilize every opportunity for raising prices by keeping back produce, by circulating incorrect information regarding the prices prevailing in other districts, and by endeavoring to create undue apprehensions regarding the effects of floods or drought on growing crops, &c., &c.

61. Under present arrangements these middlemen are of much use to the country in keeping up something like an equilibrium between supply and demand; in their absence the Ryot would at one season overstock the retail market and at another leave it altogether unsupplied. But these middlemen have at present too much power, a power which would be much lessened if reliable current price lists were published by Government once a week for general information.

62. Something is now attempted in the way of providing Agricultural Price Lists for the Madras Presidency, but the monthly statements when printed are generally three months in arrears, and therefore are not of the least practical value to agriculture.

THE SYDAPET EXPERIMENTAL FARM.

Live Stock.

63. *Cattle.*—In June we imported the Aden cattle referred to in my last report. One of the cows died during the voyage; the remaining animals, consisting of one bull, one cow, and two

calves, reached Madras in safety, but were all much out of condition when landed. The cost of the stock in Aden was Rupees 208-14-0, and for their conveyance, &c., to Madras, the charge was Rupees 630-12-0, making the total outlay on account of this importation Rupees 839-10-0. These animals are not nearly so good as I had expected that they would be ; and, if they are fair specimens of the breed, which I have every reason to believe they are, the Aden breed has been much overpraised. I make this observation with reference to their form and their general quality only ; I have not yet had an opportunity of forming a conclusive opinion regarding the milk-producing capabilities of the cow, though, from the fact that she has reared her own calf along with the calf of the cow that died, she cannot be very inferior in this respect. Both the calves are bulls ; one, the calf of the cow that died, is much inferior in form and quality to the other. If the cow should prove to be a good milker, her defects in shape may be overlooked, for it must be remembered that there are several highly-valued breeds of dairy stock in Europe, the cows of which are exceedingly irregular in form. If, by the use of bulls of the Aden breed amongst the dairy stock of the Ryot, we can succeed in producing a cross the cows of which will possess larger milk-yielding capabilities, the experiment will have been fairly successful, and the improvement in form may be attempted by the use of bulls of some other breed.

64. The services of the bulls on the Experimental Farm are now free, the small fee formerly charged being dispensed with. I made this change as I found that the fee tended to keep Ryots from sending cows to the bulls. The result has been satisfactory in the services of the bulls being in greater request than when a fee was exacted, and the amount annually collected from fees was always an exceedingly small sum. The services of the Aden bull have not been in such demand as I had anticipated, but this may be because the breed is as yet but little known to Ryots. In size and in weight the bull is well fitted for use amongst the cows of the district.

65. In my report for 1872 I gave some statistics showing the quantity of milk yielded by a Nellore cow during a period extending over twelve weeks. I have now much pleasure in being able to quote similar statistics regarding another cow (the produce of a cross between a Devon bull and a Nellore cow) ; the results of the experiment have been kindly placed at my disposal ; they have been collected with great care, and are thoroughly reliable. The registrations began from the third day after the cow calved (her third calf) and extended over a period of six months. During the whole of this time the daily food of the cow consisted of green fodder 40 lbs., ground-nut cake 4 lbs., and wheat bran 2 lbs., and about a dessert spoon of salt ; the ground-nut cake was steeped and mixed with the bran, half being given in the morning and half in the evening ; the cow was kept tied in the byre except for about two hours daily, when she was let out for exercise and to be washed ; she was milked at about seven in the morning and at five in the evening. While the cow was being milked the calf was always tied near her in the usual way, and was allowed to strip the udder, a sufficiency of milk being left for the wants of the calf. The following are the registrations :—

—	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINTS.
1st day ...	3	2	2	6	6	0	
2nd ,, ..	3	2	2	7	6	1	
3rd ,, ...	3	3	2	7	6	2	
4th ,, ...	3	4	2	6	6	2	
5th ,, ...	3	7	3	1	7	0	
6th ,, ...	3	7	3	0	6	7	
7th ,, ...	4	4	3	0	7	4	
1st week ...	25	5	20	3	46	0	138
8th day ...	3	6	3	0	6	6	
9th ,, ...	4	0	3	0	7	0	
10th ,, ...	3	6	2	4½	6	2½	
11th ,, ...	3	6	2	6½	6	4½	
12th ,, ...	3	2½	2	7	6	1½	
13th ,, ...	3	5	2	2½	5	7½	
14th ,, ...	3	0	2	7	5	7	
2nd week ...	25	1½	19	3½	44	5	134
15th day ...	3	3	2	1½	5	4½	
16th ,, ...	3	4	2	7	6	3	
17th ,, ...	3	5	2	4	6	1	
18th ,, ...	3	4	2	3	5	7	
19th ,, ...	3	5	2	3	6	0	
20th ,, ...	3	5	2	3	6	0	
21st ,, ...	3	4	2	3½	5	7½	
3rd week ...	24	6	17	1	41	7	126
22nd day ...	3	2	2	4	5	6	
23rd ,, ...	3	5	2	4	6	1	
24th ,, ...	3	4	2	5	6	1	
25th ,, ...	3	2½	2	5	5	7½	
26th ,, ...	3	2½	2	6	6	½	
27th ,, ...	3	2	2	7½	6	1½	
28th ,, ...	3	4	2	6	6	2	
4th week ...	23	6	18	5½	42	3½	127
29th day ...	3	3	2	5	6	0	
30th ,, ...	3	6	2	6½	6	4½	
31st ,, .	3	6	2	6	6	4	
32nd ,, ...	3	6	3	0	6	6	
33rd ,, ...	3	2	3	0	6	2	
34th ,, ...	3	5½	2	7	6	4½	
35th ,, ...	3	5	2	6	6	3	
5th week ...	25	1½	19	6½	45	0	135
36th day ...	3	5	2	6	6	3	
37th ,, ...	3	5	2	6	6	3	
38th ,, ...	3	3½	2	4	5	7½	
39th ,, ...	3	3½	2	4	5	7½	
40th ,, ...	3	0	2	3	5	3	
41st ,, ...	3	0	2	2	5	2	
42nd ,, ...	3	1	1	6	4	7	
6th week ...	23	2	16	7	40	1	120

—	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINTS.
43rd day ...	2	7	2	3	5	2	
44th ,, ...	2	7	2	4	5	3	
45th ,, ...	2	4	2	2	4	6	
46th ,, ...	1	6	1	3	3	1	
47th ,, ...	2	2½	2	0	4	2½	
48th ,, ...	2	2	1	7	4	1	
49th ,, ...	1	3	2	1	3	4	
7th week ...	15	7½	14	4	30	3½	91
50th day ...	2	5	2	1½	4	6½	
51st ,, ...	2	4	2	2	4	6	
52nd ,, ...	2	2	2	0	4	2	
53rd ,, ...	2	4	2	1	4	5	
54th ,, ..	2	4	2	0	4	4	
55th ,, ...	2	½	2	0	4	½	
56th ,, ...	2	4	1	7	4	3	
8th week ...	16	7½	14	3½	31	3	94
57th ,, ...	2	4	2	1	4	5	
58th ,, ...	2	3	2	1	4	4	
59th ,, ...	2	4	2	½	4	4½	
60th ,, ...	2	4	2	0	4	4	
61st ,, ...	2	4	2	0	4	4	
62nd ,, ...	2	1	1	7	4	0	
63rd ,, ...	2	4	2	2	4	6	
9th week ...	17	0	14	3½	31	3½	94
64th day ...	2	3	2	1	4	4	
65th ,, ...	2	2	2	0	4	2	
66th ,, ...	2	3	2	1	4	4	
67th ,, ...	2	2	2	1½	4	3½	
68th ,, ...	2	2½	2	0	4	2½	
69th ,, ...	2	1	2	0	4	1	
70th ,, ...	2	1	2	1	4	2	
10th week ...	15	6½	14	4½	30	3	91
71st day ...	2	4	2	1	4	5	
72nd ,, ...	2	2	2	0	4	2	
73rd ,, ...	2	3	2	0	4	3	
74th ,, ...	2	0	2	1	4	1	
75th ,, ...	2	4	2	1½	4	5½	
76th ,, ...	2	0	2	0	4	0	
77th ,, ...	2	1	1	7	4	0	
11th week ...	15	6	14	2½	30	½	90
78th ,, ...	2	0	1	7	3	7	
79th ,, ...	2	1	1	6	3	7	
80th ,, ...	2	½	1	7	3	7½	
81st ,, ...	2	½	1	6	3	6½	
82nd ,, ...	2	½	1	7	3	7½	
83rd ,, ...	2	5	1	7	4	4	
84th ,, ...	2	4½	1	7	4	3½	
12th week ...	15	4	12	7	28	3	85

——	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINTS.
85th day ...	2	5	2	0	4	5	
86th ,, ...	2	6	2	1	4	7	
87th ,, ...	2	5	2	½	4	5½	
88th ,, ...	2	6	2	1	4	7	
89th ,, ...	2	6	2	1	4	7	
90th ,, ...	2	5	2	1	4	6	
91st ,, ...	2	4½	2	0	4	4½	
13th week ...	18	5½	14	4½	33	2	100
92nd day ...	2	4	2	½	4	4½	
93rd ,, ...	2	3	2	1	4	4	
94th ,, ...	2	4	2	1	4	5	
95th ,, ...	2	4	2	½	4	4½	
96th ,, ...	2	4	2	1	4	5	
97th ,, ...	2	4	2	0	4	4	
98th ,, ...	2	5	2	1	4	6	
14th week ...	17	4	14	5	32	1	96
99th day ...	2	5	2	1	4	6	
100th ,, ...	2	5	2	0	4	5	
101st ,, ...	2	1	2	0	4	1	
102nd ,, ...	2	2	2	1	4	3	
103rd ,, ...	2	½	2	½	4	1	
104th ,, ...	2	1	2	1	4	2	
105th ,, ...	2	2	2	1½	4	3½	
15th week ...	16	½	14	5	30	5½	92
106th day ...	2	3	2	1	4	4	
107th ,, ...	2	1½	2	1	4	2½	
108th ,, ...	2	2	2	½	4	2½	
109th ,, ...	2	1½	2	0	4	1½	
110th ,, ...	2	3	2	0	4	3	
111th ,, ...	2	3	2	½	4	3½	
112th ,, ...	2	3	2	0	4	3	
16th week ...	16	1	14	3	30	4	92
113th day ...	2	2	2	1	4	3	
114th ,, ...	2	3	2	1	4	4	
115th ,, ...	2	3	2	0	4	3	
116th ,, ...	2	3	2	1	4	4	
117th ,, ...	2	3	2	0	4	3	
118th ,, ...	2	3	2	1½	4	4½	
119th ,, ...	2	3	2	0	4	3	
17th week ...	16	4	14	4½	31	½	93
120th day ...	2	2	2	1	4	3	
121st ,, ...	2	3	2	0	4	3	
122nd ,, ...	2	2	2	1	4	3	
123rd ,, ...	2	3	2	½	4	3½	
124th ,, ...	2	2	2	1	4	3	
125th ,, ...	2	3	2	1	4	4	
126th ,, ...	2	3	2	½	4	3½	
18th week ...	16	2	14	5	30	7	93

——	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS	OLKS	PINTS.
127th day...	2	3	2	1	4	4	
128th ,, ...	2	3	2	1	4	4	
129th ,, ...	2	4	2	½	4	4½	
130th ,, ...	2	3	2	1	4	4	
131st ,, ...	2	3	2	1	4	4	
132nd ,, ...	2	3	2	1	4	4	
133rd ,, ...	2	3	2	1	4	4	
19th week ...	16	6	14	6½	31	4½	95
134th day...	2	2	2	0	4	2	
135th ,, ...	2	2	2	0	4	2	
136th ,, ...	2	2	2	1	4	3	
137th ,, ...	2	2	2	0	4	2	
138th ,, ...	2	2	2	0	4	2	
139th ,, ...	2	2	2	0	4	2	
140th ,, ...	2	2	1	7½	4	1½	
20th week ...	15	6	14	½	29	6½	89
141st day...	2	0	2	0	4	0	
142nd ,, ...	2	1	2	0	4	1	
143rd ,, ...	2	1	2	0	4	1	
144th ,, ...	2	1	2	0	4	1	
145th ,, ...	2	0	2	0	4	0	
146th ,, ...	2	0	2	0	4	0	
147th ,, ...	2	1	2	0	4	1	
21st week ...	14	4	14	0	28	4	86
148th day...	2	1	2	0	4	1	
149th ,, ...	2	1	2	0	4	1	
150th ,, ...	2	1	1	7	4	0	
151st ,, ...	2	1	1	6	3	7	
152nd ,, ...	2	1	1	6	3	7	
153rd ,, ...	2	0	1	6	3	6	
154th ,, ...	1	7	1	6	3	5	
22nd week ...	14	4	12	7	27	3	82
155th day...	2	0	1	7	3	7	
156th ,, ...	2	1	1	6	3	7	
157th ,, ...	2	1	1	6	3	7	
158th ,, ...	1	0	1	6	2	6	
159th ,, ...	2	2	1	6	4	0	
160th ,, ...	2	1	1	6	3	7	
161st ,, ...	2	0	1	6	3	6	
23rd week ...	13	5	12	3	26	0	78
162nd day...	1	7	1	6	3	5	
163rd ,, ...	2	2	1	5	3	7	
164th ,, ...	2	1	1	5	3	6	
165th ,, ...	2	1	1	5	3	6	
166th ,, ...	2	0	1	6	3	6	
167th ,, ...	2	0	1	4	3	4	
168th ,, ...	2	0	1	5	3	5	
24th week ...	14	3	11	4	25	7	78

In these records a measure is calculated to be equal to three imperial pints ; fractions of a pint are omitted unless over a half, which is calculated as one pint ; the exact contents of a standard measure is 104 cubic inches, while an imperial pint contains 34·659 cubic inches.

66. The following statement exhibits the quantity of milk yielded by the cow in each of the months over which the experiment extended :—

	MRS.	OLKS.	PINTS.		MRS.	OLKS.	PINTS.
1st week	46	0	138	13th week...	33	2	100
2nd ,, ...	44	5	134	14th ,, ...	32	1	96
3rd ,, ...	41	7	126	15th ,, ...	30	5½	92
4th ,, ...	42	3½	127	16th ,, ...	30	4	92
Yield in 1st month ...	174	7½	525	Yield in 4th month ...	126	4½	380
5th week	45	0	135	17th week...	31	½	93
6th ,, ...	40	1	120	18th ,, ...	30	7	93
7th ,, ...	30	3½	91	19th ,, ...	31	4½	95
8th ,, ...	31	3	94	20th ,, ...	29	6½	89
Yield in 2nd month ...	146	7½	440	Yield in 5th month ...	123	2½	370
9th week	31	3½	94	21st week...	28	4	86
10th ,, ...	30	3	91	22nd ,, ...	27	3	82
11th ,, ...	30	½	90	23rd ,, ...	26	0	78
12th ,, ...	28	3	85	24th ,, ...	25	7	78
Yield in 3rd month ...	120	2	360	Yield in 6th month ...	107	6	324

67. The total quantity of milk yielded during the six months was 799 measures and 6 ollocks or 2,399 imperial pints. The prices paid for the food, &c., of the cow during the experiment were as follows:—ground-nut cake 65 lbs. per rupee, bran 32 lbs. per rupee, green fodder 300 lbs. per rupee, straw for bedding, salt, &c., 1 rupee per month, and attendance Rupees 3 per month (the man having other duties to perform). The total cost incurred during the six months was—

	RS.	A.	P.
168 days, green fodder at 40 lbs. daily	22	6	5
168 ,, ground-nut cake at 4 lbs. daily	10	5	5
168 ,, bran at 2 lbs. daily	10	8	0
Straw and salt	6	0	0
Attendance	18	0	0
Total...	67	3	10

If from this amount we deduct Rupees 15, the value of the calf at six months old, there remains Rupees 52-3-10 as the cost of the 799 measures and 6 ollocks of milk or, say, in round numbers, 800 measures for Rupees 52 equal to one anna per measure ; it should, however, be remembered that the yield of milk will gradually continue to diminish until the cow again calves, and, as the cost of maintaining the cow up to that period will not be less than when in full milk, the cost of the milk will be proportionally increased, but throughout the year the milk will not cost 2 annas per measure. As in the larger towns of Southern India, milk of very inferior quality sells readily for 3 annas per measure ; it will be seen that in dairying a *very* profitable business could be established, and one well worthy of the attention of the "Poor Whites" of this country, regarding whom of late we have heard so much. But a dairy to be successful must command the confidence of the public.

68. It will be observed that the return for the 7th week is 25 per cent. less than the yield of the previous week ; this sudden diminution was due to the cow having been milked by a person

to whom she was unaccustomed, the man who always milked her being absent from sickness ; this change proved very unfortunate, for though, when the regular milker returned to his duties in the 13th week, the yield somewhat improved, it was still very much below what it would have been had the change referred to not occurred. I think it necessary to call particular attention to the facts just stated, for, though some cows will give the same quantity of milk to any milker, it is well that it should be known that with some cows a change in their attendant may lead to a very large reduction in the quantity of milk obtained.

69. During the first four months of the experiment the calf was allowed to take daily about one measure of milk, and about half a measure daily during the other two months ; this milk was, of course not brought to account in the foregoing registrations ; I think it an advantage in this country to allow the calf access to its mother before and after milking as is customary in this part of India, not only does the cow yield her milk more freely, but what is of more importance her udder is thoroughly stripped after each milking ; and, with the help of other food the calf can be reared at a very moderate cost. The first calf of the cow referred to was reared in this manner until about a-year old, when it was fed on food similar to that given to its mother ; it was always in good condition, and will calve at three years old, fully a year earlier than it is usual for heifers to calve in this country.

70. I attach very great importance to this experiment ; there is not, as far as I am aware, any published record of any similar experiment made in this country excepting that detailed in my report for 1872 ; and, before we can attempt to do anything to improve the dairy stock of the country, which so greatly needs attention, we must have reliable data for the guidance of our efforts.

71. *Sheep.*—I regret exceedingly to state that the opinion I expressed in my last report regarding the probable effects of the Madras climate on the health of the sheep imported from China has proved correct. At the close of the year the only sheep left of this breed were one ram, one ram lamb, and two gimmer lambs, and I fear that neither of the rams will be of any use. Great care was taken of the sheep, but they never throve in a satisfactory way after the commencement of the hot season.

72. The result of the experiment is unfortunate, as the breed possesses many valuable qualities, some of which, it is desirable, should be stamped on the sheep of Southern India ; amongst these characteristics are great length and depth of frame and ribs remarkably well arched, a fair yield of wool—very fine and lustrous—and great prolificness in the ewes.

73. It will be observed that all the sheep imported have died with the exception of one ram. Two of the ewes were in lamb when they arrived in Madras ; one of these a month afterwards gave birth to three lambs, but died on the day following, when it was ascertained that there was a dead lamb in the womb ; the other ewe shortly afterwards produced two fine lambs. It is a rare occurrence for ewes of the indigenous breeds found in Southern India to give birth to more than one lamb at a time ; though the Sydapet flock has in some years contained as many as 150 ewes, I have never, in a single lambing season, known more than two or three cases to occur of births of twins. As I have before had occasion to observe, it is very undesirable that anything should be done to increase indiscriminately the prolificness of the ewes kept by Ryots in Southern India until some better means are in existence for providing the ewes with food until their lambs are able to take care of themselves ; under usual circumstances it is now in most districts, in ordinary seasons, as much as the ewes can do to secure food for their own support, their single lambs, from unsuitable and insufficient food, growing up into animals that seldom pay for the food they consume when put up to fatten for the butcher. But if it is undesirable to increase indiscriminately the lamb-producing abilities of our ewes, there is no reason why this improvement should not be attempted with sheep in a few favored localities, and I would strongly recommend a further importation of Chinese sheep for use in experiments in such districts.

74. There is, I fear, now but little probability that we will be able to meet with a breed of sheep suited for use in improving the Sydapet breed, for all the breeds with which I am acquainted that possess superior qualities such as it is desirable to stamp on the Sydapet breed are quite unable to withstand the ill effects of the Madras climate, and it would be exceedingly unfortunate if, in attempting to add any new quality to those possessed by sheep of the Sydapet breed, they should be rendered less hardy and less able to encounter the effects of a high temperature.

75. The following details regarding the management of the Sydapet flock will supply the information for which I am frequently asked. All rams are kept entirely separate from the ewes ; after being weaned, the ram lambs are reared in pens and are only occasionally allowed to graze ; their food consists of green fodder and ground-nut cake. I should much prefer that these sheep should be grazed more frequently instead of them being so much confined in pens, but it is so extremely difficult to keep the rams apart from the ewes when both flocks are grazing, however I intend forming a grass paddock wherein the rams can be secured and in which they can obtain food and regular exercise during certain hours of each day. The rams are not used until they are about two and-a-half years old, at which age a good specimen will weigh from 100 to 120 lbs. live weight. The ewe flock is generally sorted over once a-year, and those of a bad form or color or with inferior wool, as well as those that have lost some of their teeth, are taken out of the flock and put aside for fattening. In September the ewes that remain in the flock are, with a number of gimmers then about eighteen months old, put to the ram ; about forty ewes are placed with one ram the breast of which is colored to mark the ewes in a way that enables the shepherd to detect readily those ewes that have been served, which he removes from the flock. The lambs are born about five months after, generally about 90 per cent. of the ewes proving in lamb. The ewes when about to lamb are placed in pens, three or four in each, where they are kept until their lambs are about three weeks old, after which they are again put into the flock in the sheepfold. All males that do not promise to turn out well are, when about six weeks old, made into wethers. When about three months old the lambs are removed from their mothers and are weaned, about a fortnight's separation sufficing for this, after which the wether and gimmer lambs are grazed in the flock with the ewes, the ram lambs being placed by themselves as previously noticed. All the sheep are generally clipped in April, which, I find, is the best month in the year for the purpose. When the ewes are being clipped, it is usual to mark the lambs in a way to render their identification easy ; in the farm flock this is done by cutting a small hole by means of an ear-pincer in the cartilage of one ear of each. During the season of the year when night dews are heavy the sheep do not leave the fold in the morning until the sun has removed the greatest part of the dew ; it was found when the sheep were turned out too early in the morning to feed upon grass heavily covered by dew that a number of them were invariably attacked by dysentery of a severe type. During the hottest part of the day the sheep return to the fold for a few hours, and again go to graze until about five in the evening, when they again return and receive about half a pound of ground-nut cake per head, and are shut up in the fold for the night. During very dry weather they receive, in addition to the cake, a small quantity of green food, but they are maintained chifley by the food they gather when out grazing. The sheep thus fed are kept in a thriving condition; they are, of course, not fit for the butcher, but they are generally in the condition that it is most desirable for breeding stock to be. I have tried various months in the year in which to put the ewes with the ram. Under the impression that lambs born in December would thrive best from the abundant grass at that season available, I put the ewes with the ram in July, but the result of the experiment was disastrous, as a very large proportion of the lambs died, evidently, I think, from their mother's milk being unfitted for them, the result of the too liberal consumption of immature hastily-grown grass. Next year the lambing season was postponed a fortnight, and the result was fewer deaths amongst the lambs. From this time the lambing season was each year made later until it fell in the middle of February, at which time of year it

was found that fewest deaths occurred amongst the lambs, the death-rate having sunk from at the least 20 per cent. down to at the outside 5 per cent. This experience may be useful to owners of flocks; it was only recently that I was consulted regarding the management of a flock the lambs of which every lambing season died in great numbers; on inquiry, I was informed that each year's lambs generally fell about a month after the close of the monsoon rains, and to this fact I attributed the great mortality. Whenever ewes are suckling their lambs, and are feeding on the hastily-grown grass produced by the monsoon, loss amongst the lambs will be inevitable; I am convinced that the only way to avoid great mortality amongst lambs in Southern India is to arrange for their birth to occur after the sun has had time to harden the monsoon grass, and remove its pernicious qualities.

76. *Pigs.*—In my last report I referred to some Chinese pigs that had recently been received at this farm. Though every care was taken of them they never thrived, and have all died with the exception of one boar, which will not, I think, long survive the others, it is now in such a very feeble state of health. Besides this, there were at the close of the year four young pure-bred Chinese pigs, and a sow of the farm breed, which was served by the Chinese boar, is shortly expected to litter. It will thus be seen that the experiment, as far as it has yet proceeded, does not promise to yield very encouraging results; however, should it so happen that all the pure-bred animals should die, which is not improbable judging from our recent experience, we will, I think, make sure of some good resulting from the importation, in the half-bred pigs shortly expected. These Chinese pigs were not imported in order that they might be maintained as a pure breed; the intention was to cross them with the breed already at the farm in order that this breed might be stamped with some of the qualities which the Chinese breed possesses.

77. The pigs we imported from China were not of the quality I had anticipated from reading the eulogiums passed on the breed by English agriculturists, who wrote in the beginning of the present century, when the Chinese pig was attracting so much attention in England; and, if the pigs received are fair representatives of the breed now found in China, the English pig-breeders are now far in advance of the Chinese in the quality of the animals they now raise.

78. The Chinese have long devoted much care to the breeding and rearing of pigs, pork forming so large a proportion of the food of these people. It is said that Chinese pigs are very prolific, that they fatten rapidly on a very moderate allowance of food, and that their flesh is excellent, but they are not considered a hardy breed.

79. It may not be generally known that most of the best breeds of pigs now found in England and in France owe many of their most valuable qualities to the Chinese pig, which about 70 or 80 years ago was imported largely into England and France, and used for improving the indigenous breeds which were then very coarse and inferior, and widely different in every way to the pigs now found in these countries.

80. *Poultry.*—Arrangements have been made for procuring from Sydney a number of poultry of the best English breeds consisting of Brahma and Dorking fowls and Aylesbury ducks. When these arrive in Madras, they will be sent to this Farm, where they will be kept for raising stock for distribution over the country in view to improve the indigenous breeds of poultry.

81. Heretofore, with the exception of the birds of the Brahma-Dorking breed which were given to the people of the Wudder Settlement at Sydapet, it has been usual to charge the full value for all poultry obtained from this farm, but I trust that it will be found possible to extend largely the practice followed in the case of the Wudders and to distribute male birds of improved breeds gratuitously to the headmen of villages under certain conditions. I believe that in this way a great amount of good can be done at a very moderate cost; it is true that in many localities from the absence of natural food during a considerable period in the year, and the neglect of the people in providing proper food, superior breeds of poultry would degenerate, but there are

many localities in which natural food is abundant throughout the greater part of the year that might be selected for the experiments I have suggested.

82. I sent to Sydney for the poultry, because the former lot I received from there, proved so very satisfactory ; I have not made any experiments in getting out poultry direct from England, but I am acquainted with the results of many such experiments from which it appears that there is generally a great loss of life during transit from England, and that the birds which survive the voyage are seldom able to encounter the great heat of the Madras climate.

83. The *American Agriculturist* of September last drew attention to some ducks which had just been landed in New York of a breed that had previously been unknown in America or Europe. These ducks had been brought from Shanghai, where they had been hatched from eggs obtained in the city of Pekin. The account stated that from their size the ducks were in appearance very like small geese ; it stated that they were very uniform in size, and that a pair, only four months old, weighed 12 lbs. From this description, I was induced to enter into correspondence with Messrs. Arbuthnot and Co. of Madras in view to obtaining some specimens of this apparently valuable breed ; these gentlemen very kindly arranged with Messrs. Matheson, Jardine and Co., of Hong Kong, to procure in Pekin and send to Madras a number of pairs of these ducks ; if these prove to be at all equal to the description given of the breed in the American Newspaper, the ducks will be a valuable introduction here. Our indigenous breeds are very poor, while the facilities for rearing ducks are great in most parts of the Presidency.

Crops.

84. *Field experiments.*—Several series of experiments with manures of different kinds, applied in different quantities, were commenced at the beginning of the last cultivating season ; but, owing to the absence of seasonable rains after the crops were sown, most of these experiments had to be abandoned, and the crops that were partially successful were valueless in affording information regarding the comparative values of the manures used ; these results were especially unfortunate, seeing that in the previous year the weather was also unpropitious for field experiments. It is highly desirable that we should devote great attention to field experiments ; there is so much to be learned regarding the peculiarities of the various crops we grow, and the effect on them of dressings in various proportions of the different manures available in Southern India. Not only are these experiments very costly in the amount of labor and supervision they absorb, but as they must be made at the season of the year, when the ordinary cropping of the Farm requires all the attention and labor that can be devoted to it, they are exceedingly troublesome ; however, I should not grudge the expenditure these experiments cause of time and money, if we could but insure that even a very small proportion of them would meet with the conditions necessary to give a practical value to the information they yield. It is very discouraging to see so much labor wasted when a drought causes an experiment to be abandoned.

85. At present on the Experimental Farm, owing to the absence of means for irrigating the land, we have no alternative but to begin our field experiments shortly before the time the rains of the north-east monsoon are due, when the weather is always very irregular and uncertain. Of course, field experiments never can be conducted with that scientific exactitude that is desirable, but the conditions under which they are placed should as far as possible be under control ; and to obtain this, it is necessary that they should be instituted at the season of the year when the weather may be expected to be calm or somewhat uniform in character. I have found at Sydapet that only one out of every two or three monsoon seasons is at all favorable for the carrying out of comparative experiments in the field with different manures. The best time at which to begin such experiments would be about the middle of November, when in an ordinary season the heaviest burst of the monsoon will be over; there are, however, but few of our crops, that when sown so late would reach maturity unless irrigated, and this unfortunately we cannot do except on a very limited scale. It is very desirable that the channel to be made for supplying the Sydapet Farms with irrigation

water should be made with the least possible delay, not only that the field experiments may be conducted with more certainty of their reaching completion, but also to afford the means for carrying out the many field experiments that must be instituted for educational purposes on the Establishment of the School of Agriculture.

86. *Seed-sowing.*—The following experiment was made in order to ascertain the most suitable depth at which to sow maize and cotton. Fifty grains of each kind of seed were carefully sown at depths varying from 1 inch, to 5 inches. The soil was kept in a moist condition during the time the experiment was proceeding :—

New Orleans Cotton.

When counted.	Sown 1 inch deep.	Sown 2 inches deep.	Sown 3 inches deep.	Sown 4 inches deep.	Sown 5 inches deep.
Number of plants that appeared above ground.					
1st day... ...	...	...	...	...	...
2nd ,, ...	...	...	...	...	...
3rd ,, ...	...	...	...	...	...
4th ,, ...	...	...	...	...	...
5th ,, ...	15	...	...	...	...
6th ,, ...	32	8	1	...	...
7th ,, ...	33	12	5	...	...
8th ,, ...	33	17	8	...	...
9th ,, ...	33	17	8	...	...

The seeds sown at 1 inch in depth produced 33 plants, or 66 plants for each 100 seeds, and the whole of these plants had appeared before the close of the seventh day after sowing ; the seeds sown at 2 inches gave a return of only 34 plants for each 100 seeds ; and the whole of these plants did not appear until the eighth day after sowing. The seeds deposited at 3 inches in depth produced only 16 plants for each 100 seeds, and these were not all above ground until the eighth day. It will be seen that no plants were produced from the seeds sown at 4 inches and at 5 inches.

Maize.

When counted.	Sown 1 inch deep.	Sown 2 inches deep.	Sown 3 inches deep.	Sown 4 inches deep.	Sown 5 inches deep.
Number of plants that appeared above ground.					
1st day	...	...	...	...	...
2nd ,, ...	...	...	...	...	...
3rd ,, ...	...	...	...	...	...
4th ,, ...	...	...	...	...	...
5th ,, ...	10	...	...	...	...
6th ,, ...	27	4	...	...	...
7th ,, ...	38	6	...	...	...
8th ,, ...	39	13	4	...	...
9th ,, ...	40	16	9	...	...

The 50 grains of maize sown at 1 inch produced 40 plants. The same quantity of seed sown at 2 inches produced only 16 plants ; a similar quantity sown at 3 inches in depth yielded only 13 plants. It will be observed that the maize plants, like the cotton appeared much more quickly when the seed was lightly covered by soil.

87. From these experiments it would appear that shallow-sown seeds of the kinds experimented with not only germinate much more quickly, but produce a great many more plants than seed that is buried more deeply in the soil ; but it must not be inferred from this that shallow sowing is more likely to produce good results than deep sowing, for the information above given is only a portion of that the experiment is expected to yield ; we have yet to ascertain whether the more rapid first growth of the plants produced from shallow-sown grain is supported by an equally-luxuriant root-growth upon which the ability of the plant to withstand the illeffects of a long drought so greatly depends. I am inclined to think that with such large seeds as maize and cotton, 1 inch is too shallow a depth at which to sow them, and, in practice, I seldom sow these seeds at less than 2 inches in depth ; but then this is only upon deeply-cultivated and well-pulverised soil, whereas the soil used in the experiment resembled in its physical condition the soils of the Ryot. I believe that the more deeply the seed can be sown in the soil with due regard to its germinative powers the more certain will the plants produced from it reach maturity ; but to ensure the proper germination of deeply-sown seed, it is absolutely necessary that the soil in which it is sown should be in a high state of cultivation in order to admit of rain water filtering freely through it, and in its way carrying down atmospheric air to the buried seed. It must be remembered that germination cannot take place except under the influence of air, heat, and moisture ; seed that is too deeply buried in a close badly-cultivated soil will altogether fail to germinate. The experiment, as far as it has proceeded, shows how important it is, in order to secure a uniform growth of young plants, that the seed should be deposited at a uniform depth in the soil. I need scarcely point out how necessary it is, in order to secure the best results at harvest from every individual plant, that we should, as far as possible, bring all the plants in a crop to maturity at one time, which can be secured only by regular sowing. Badly or unevenly sown seed must, as the experiment shows, produce plants of great unevenness in growth, these at harvest will mature at very different times, leaving the Farmer no choice but either to wait for the backward plants, and thus lose seed by the shedding of the too ripened grain, or, cut down the whole when the first plants reach maturity, and sacrifice the produce of those not yet matured. I hope in my next report to be able to state the further results of the experiment just noticed.

88. *Carolina Rice.*—The following particulars, respecting two samples of country-raised Carolina rice, which Messrs. Walker and Co. of Madras very kindly forwarded to England on my behalf, may possess some interest.

89. Parcel A was prepared from 8 Madras measures of Carolina paddy and consisted of 3¾ Madras measures of clean rice. Messrs. Walker and Co. were good enough to have the paddy husked in the same way that it is usual in Madras to husk all paddy intended for export to England The 8 measures of paddy yielded as follows :—

	By volume. Per cent.
Clean rice fit for the Home Market	46·87
Broken rice	3·13
Husk and wastage	50·00
	100·

With reference to this result, Messrs. Walker and Co., wrote to me : " We are not very well satisfied as to the result of the husking, the grains are more broken than is desirable, but the coolies say they found it more difficult to husk the paddy than the ordinary native grain." With reference to the cost of husking, they wrote : " The cost of husking the 8 measures is 1 anna, and we can contract at this rate for all you intend sending to England. In the same letter they remarked, " the wastage on this 8 measures may be taken as a fair average."

90. Parcel (B) consisted of 623 pounds of cleaned rice prepared from 448 Madras measures of country-raised Carolina paddy. In addition to the clean rice there were 24¾ measures of broken rice, the value of which was in Madras one anna per measure.

91. The following letter refers to parcel B :—

Dear Sir,

We now wait on you with our Broker's report and valuation on the four bags of rice sent to London on your account by S. S. *Sultan*, and we trust the report will be considered satisfactory. We may mention that while your rice is valued at 10*s.* 4¼*d.* to 10*s.* 6*d.* per cwt., *ordinary* "Pinky" was sold at 9*s.* 6*d* to 10*s.* 7¼*d.* for *good.*

(Signed) WALKER, AND CO.,

Broker's report on four bags

of rice per *Sultan.*

W. & Co.
R.

"The rice proves to be very fine white grain, and, in quantity, would command 10*s.* 4¼*d* to 10*s.* 6*d* ; it is different from what is known as "Pinky," and we doubt if the Starch-makers, who are the largest consumers of this particular sort, would like it so well ; but for cleaning purposes, it would meet a ready sale."

92. The rice was sold in London in the usual way ; the price realized, 11*s.* 6*d.* per cwt., was only a trifle higher than the price ruling at the time for ordinary Madras rice. This result was somewhat disappointing ; judging from the value generally put upon Carolina rice in London, I had anticipated a much larger price than was obtained.

93. It is, I think, probable that the very high price that Carolina rice, imported from America, commands in England is due chiefly to the very superior way in which it is prepared for market. The Madras grown Carolina paddy, from which the rice (Parcel B.) was prepared, was, as far as I can judge, quite equal in quality to the Carolina paddy which was imported into this country from America, and which was the seed from which the paddy in question was raised. I cannot offer any opinion as regards the appearance of the sample of the Madras prepared Carolina rice, in comparison with the appearance of the rice prepared under the milling processes usually followed in America ; but I can readily believe, from what I know of the processes followed in this country and in America in preparing rice for market, that the appearance of the American rice must be very greatly superior to the appearance of that prepared in Madras. In Madras, the husk merely is removed ; there is no attempt to remove the dark-colored surface which is found immediately beneath, and very little is attempted in the way of sizing the grain ; the whole process, such as it is, being performed by women by means of a pestle and mortar and a bamboo sieve. The following extract from a report published by the Department of Agriculture in the United States of America shows the process under which the Carolina rice of that country is prepared :—

"The rough rice is first ground between very heavy stones running at a high speed, which partially removes the rough integument or hull chaff. This chaff is passed out of the building by spouts, and the grain by similar means conveyed into the mortars, where it is beat or pounded for a certain length of time by the alternate rising and falling of very heavy pestles shod with iron. These are operated by a revolving cylinder of huge dimensions armed with powerful levers, which passing into a long opening in the pestle, about 15 feet in length, raise it in mid-air and let it fall suddenly into the great mortars below. From the mortars elevators take the rice to the fans, which separate the grain from the debris. From thence it goes through other fans that divide it into three qualities, known as "whole," "middling," and "small rice." The grain is lastly passed through a polishing screen lined with gauze wire and sheep-skins, which, revolving vertically at the greatest possible velocity, embellishes it with that pearly whiteness in which it appears in commerce." I need scarcely

remark that this great nicety in the preparation adds nothing to the food-value of the rice. Indeed, I believe that in the attempt to get a very white-colored rice, a large quantity of valuable human food is lost, as the portion of the seed immediately below the husk or outer skin contains the largest proportion of nutritious matters. It may be well enough to prepare rice for the London market in the way it is usually prepared in America ; in England, there is always a demand at high prices amongst the luxurious and wealthy for produce either exceptionally good or exceptionally well prepared, and as rice forms but an exceedingly small proportion of the food eaten by Englishmen, the loss of nutritive matters by the unnecessary refinement of the process under which the rice is prepared is of little moment. The case is widely different in a country like this, with a people subsisting so largely on rice ; in their case the loss of even a very small quantity of nitrogenized matter by a greater refinement in the preparation of their rice would be a very serious loss indeed. In England, the intrinsic value of rice as human food enters but little into the commercial value set upon it ; the points of excellence specially demanded are, uniformity in size and color which must be a pearly white, matters of but small importance to rice-consumers in this country. If these views are correct, there is at present not much to induce the Cultivators of this country to grow Carolina paddy on an extensive scale for the Home market, for, not only must they produce a first-class sample of paddy, but there must be at work the agencies required to convert that paddy into the superior quality of rice required. In its superior productiveness, its superior quality, its less aquatic habits and other qualities to which I have alluded in former reports, Carolina paddy possesses many advantages over our indigenous varieties of paddy ; but, I fear, it is hopeless to expect to secure from Madras raised Carolina rice the high price that American raised Carolina rice commands in London, until we can prepare rice for market in a way equally as good.

94. *Wheat.*—Several small plots were sown with wheat ; some with seed obtained from the Neilgherries, and others with seed produced in the Coimbatore District ; the sowings were made at different dates, between the 1st of January and the middle of March. The seed from both districts germinated well, and produced vigorous and healthy plants ; however, only a very small proportion of them succeeded in maturing any grain, the result evidently of the high temperature that prevailed during the latter half of their growth. I think that, had the sowings been made not later than the middle of November, in order to secure the harvest in January, the result would have been very different. The plants up to the time they began to flower were very healthy and strong. The experimental plots were all thoroughly cultivated and liberally manured, and irrigation water was applied when necessary. I intend to make further experiments with wheat on the Sydapet Farms, if we are successful in meeting with a variety that can be grown generally over the plains of Southern India, wheat cultivation might be considerably extended. An average crop of wheat will yield a much larger quantity of human food than an average crop of paddy, while a supply of water that would but just suffice to mature one acre of paddy would be ample to meet the requirements of two or three acres of wheat.

95. *Maize.*—A plot of land measuring 1,950 square yards was, on the 15th of January, sown with 14½lbs. of maize seed. The soil was a free sandy loam ; it was twice ploughed, twice harrowed, manured with 1,500 lbs. of oil cake and fourteen cart-loads of ashes, and ridged. During the growth of the crop the land was five times irrigated and once hand-hoed. The plants grew so luxuriantly, it was found necessary to thin out a considerable number ; the weight of fodder thus obtained was 1,134 pounds. The remainder of the plants matured three months after sowing, and produced 1,738 cobs and 1,324 pounds of dry straw. The cobs were small from the plants having been too crowded on the ground. The experiment is worthy of notice, because the sowing was made out of the usual season, September being the usual seed time for maize ; and, also, on account of the crop having been occasionally watered instead of treated as a dry crop. If we can succeed in producing as good crops of maize, with the aid of occasional irrigation, from sowings made just after the monsoon as we can produce from sowings made in the usual season, the

change will be well worth adopting, as maize from its tall, upright growth is especially liable to injury from the effects of high winds which generally prevail during the monsoon.

96. *Yellow Cholum* (*Sorghum vulgare*).—I have frequently drawn attention to this valuable fodder-crop, and I would again do so, as its value is yet but little appreciated by those who might benefit most largely by cultivating it. Most of the live-stock on the Sydapet Farms are fed on cholum fodder throughout a greater part of the year; the crop is therefore cultivated on these Farms on rather an extensive scale. The following details refer to a crop which was produced on a plot of ground, measuring 2,494 square yards. The soil was a stiffish loam; before being sown it was prepared in the following way: once ploughed, once harrowed and ridged; then manured with ten cart-loads of farm-yard manure, and again ridged over the manure; the ridges thus formed being about 24 inches apart. The seed was sown on these ridges on the 2nd of June; it germinated well and produced strong and healthy plants. The crop during its growth was hoed by hand twice, and was sixteen times irrigated. The crop, three months after sowing, was cut down for use as fodder, when its total weight was found to be 4 tons 10 cwts. and 50 lbs., equal to 8 tons 15 cwts. 59 lbs. per acre, a quantity sufficient to support two ordinary milch cows during a year.

97. We have occasionally produced much heavier crops than this: thus, the plants growing on 75 square yards of a plot sown with yellow cholum were found to weigh 661 lbs., which is equal to a yield of 19 tons 2 cwts. and 66 pounds per acre. This large yield was obtained only on a portion of the ground, the remainder of the crop not being so good; but the result shows what it is possible to achieve in the production of cholum fodder. This large return was obtained from plants only nine weeks old.

98. *Jute* (*Corchorus Olitorious*).—Several experiments were made in the past year in the cultivation of jute with seed obtained from Bengal. The soil of most of the experimental plots was a free sandy loam. Manure was applied in each instance generally at the rate of about ten cart-loads per acre. The soil was thoroughly worked and cleaned; in some cases it was ridged. The sowing of the different plots was done in different months, some were sown in June, others in July, in August, and in October. The seed was always sown in lines either on the ridge, or on the flat. The distances between these lines varied in the different plots; in some instances the intervals between the lines were 12 inches, while in others they were as much as 2 feet. The quantity of seed sown in the lines also varied in the different experiments. The seed in every instance germinated well, and there was generally a good covering of healthy plants before the expiration of the first fortnight after sowing, but, when about a month or five weeks old the plants began to flower and to throw out side branches, these latter grew with great vigor, and soon exceeded the main stems in size, as a rule, when the height of the plants was not more than 18 inches, these laterals measured from 2½ to 3 feet in length. The flowers on the lower portions of the plants had generally matured and produced seed by the time those on the higher branches had begun to appear. A few plots were planted with seedlings which had been removed from the more thickly-sown crops; these readily took root and grew with great vigor, but they, like the plants from the seeds sown at once in the field, flowered when only about one-third grown, and threw out a large number of side branches. Each experimental plot was hand-hoed and cultivated during the growth of the crop, and a few of the plots were occasionally irrigated.

99. One object of the cultivation was to produce seed for distribution, and in this respect a certain amount of success was achieved, about 150 pounds of seed having been collected; but I did not think it wise to distribute any of it, seeing that the plants from which it was gathered were so inferior in shape and in size. The general results of the experiments were in every instance unsatisfactory, whether the sowings were made during the hot weather or during the rains, whether the seed was sown thickly or thinly, in lines at narrow or wide intervals, or whether the crop was irrigated or watered only by rainfall.

100. It is possible that the seed obtained from Bengal may have been produced in a climate too widely different from that of Madras, but the plants produced from the Sydapet raised seed were in no respect superior to those produced from the Bengal seed. I am inclined to think that the climate of this part of Madras is too dry for jute, and that a climate better suited for its culture will be met with in the northern districts of the Presidency.

101. I made no use whatever of the plants, as I did not consider that the value of the fibre obtained would cover the cost of its preparation.

102. I hope to be able to continue these experiments with seed produced in the northern districts of this Presidency.

103. *Roselle* (*Hibiscus subdariffa*) ; *Sunn Hemp* (*Crotalaria juncea*).—A plot of land, measuring 1,210 square yards, was sown with roselle seed. The soil was a free sandy loam. It was prepared for the crop in the following way : twice ploughed, once harrowed and ridged ; then manured with 3½ cart-loads of farm-yard manure, and again ridged over the manure ; on the 1st of February six pounds of seed were sown on the ridge. During the growth of the crop, the land was once hand-hoed, once bullock-hoed, and eighteen times irrigated. The seed germinated well, and the plants grew with great vigor ; they were straight and almost without side branches, and averaged between 5 and 6 feet in height when ready for cutting, about three months after sowing. As the crop was grown chiefly in view to the production of seed, the fibre of the plants was not utilized ; a few plants were, however, cut down when in flower, in order to ascertain the quality of their fibre, the result was very satisfactory, for the fibre proved to be long in staple, strong, and silky.

104. Another plot of land of the same area as that sown with roselle seed was, on the 2nd of February, sown with 14 lbs. of sunn hemp seed. The treatment of the land was precisely similar to that of the land sown with roselle. It was also similarly manured ; and the treatment of the crop during growth was also the same. The seed germinated well, and the plants grew with great luxuriance, but when they had reached the period for cutting, there was no fibre whatever in their stems. It is, I think, probable that by the liberal use of manure and water, the plants were caused to grow too rapidly for the proper development of their fibre.

105. From the results of these two experiments, it would appear that while high culture is very advantageous to the roselle plant, it has quite a contrary effect on sunn hemp as regards the production of fibre, at any rate on soils similar to those on which these experimental crops were grown.

106. *Guinea Grass.*—A plot of land, measuring 4·77 acres, was, on the 28th November last, planted with Guinea grass ; the soil was a sandy loam of rather a stiffer character than the prevailing soils of this farm. After three ploughings, the land was manured with 4,000 lbs. of cotton seed, the vitality of which had been previously destroyed ; the soil was then raised in parallel ridges about 9 inches in height and 2 feet apart ; the plants were put in on these ridges at every 2 feet, care being taken that the lines they formed across the field were at right angles to the lines formed by the ridges, thus affording facilities for the employment of the plough during the growth of the crop, both between the ridges and across them. The plants, with which the ground was planted, were removed from tussacks of this grass growing in another field. A wet day was selected for planting, and nearly every plant took root. The following shows the cost of planting this field :—

	RS.	A.	P.
Ploughing three times and ridging	7	8	0
Four thousand pounds cotton seed	40	0	0
Carting and spreading manure...	2	4	0
Labor in planting	8	5	0
Carting plants to field	1	4	0
Total ...	59	5	0
Cost per acre ...	12	6	11

The field has since received one hoeing. No irrigation water whatever has been applied to the crop, either at the time of planting or subsequently. The rain-fall, as will be seen by the following, was during the past three months unusually light:—

Month.	Wet Days.	Inches.
November (from 28th)	1	3·38
December	5	5·11
January	1	0·10
February	—	—
March	1	0·77

The first cutting was obtained in February, and the yield was 3 tons and 56 lbs.; another cutting was obtained in March, which weighed 2 tons and 20 lbs., and there was at the end of the month another crop of about the same weight ready for cutting. The experiment will be continued over another year, and the further results will be reported.

107. I have before recommended Guinea grass as being well suited for culture in the plains of this Presidency, and I would again strongly advise its extended cultivation. It will, I think, form an excellent rotation grass for arable land; at present there is in the agriculture of this Presidency no crop equivalent to the fodder and root-crops of other countries, and this want Guinea grass promises to supply. Not only is the plant from its habit of growth, an entire change for the soil, but the system of cultivation pursued with it, admits of the soil being kept in a fine state of tilth; while the blades of the grass form such a dense covering, weeds are most effectually kept in check, especially those that usually appear in the crops more commonly cultivated. Land which was kept clean with difficulty and at a great expense when under ordinary crops cost very little for weeding when under Guinea grass, this being due to its vigorous growth and to the low and close shade afforded by it, and to the facilities the system of culture affords for keeping down the weeds.

108. Guinea grass is well suited as a change-crop for land that has long been cultivated with one kind of crop only, and has become infested by certain kinds of weeds or insects such as that crop encourages.

109. Guinea grass can be cut over regularly for fodder, or it can be grazed by cattle and sheep; for use in the latter way it is excellent, though in showery weather it is better to utilize it in the former way.

110. Under the system described, the land on which the crop is growing can be manured at any time, and, of course, the more liberally manure is used the better will be the results.

111. *Casuarina Tope.*—A piece of land, measuring 760 square yards, was, on the 5th of July last, planted with 173 casuarina seedlings, aged about 5 months. The dimensions of the pits were 18 inches in each direction; they were made at about 6½ feet apart. A dressing of four cart-loads of farm-yard manure was distributed in the pits at the time of planting. The seedlings took root and grew rapidly; they were five times watered between the time of planting and the close of the year under review. The following shows the cost incurred on this experiment up to the end of the year:—

	RS.	A.	P.
Digging pits and planting	3	12	0
Value of trees	1	8	0
Do. of manure	4	0	0
Watering	2	8	0
Pruning, &c.	1	0	0
Total ...	12	12	0

These trees have made a most extraordinary growth, their average height on the 1st of April being fully six feet. The further results of the experiment will be duly reported.

MANURE.

112. *Loss to Agriculture from the Practice of using Cattle-dung as Fuel.*—It has been asserted with some degree of prominence by a would-be agricultural authority that it is a delusion to believe that Indian Agriculture suffers largely from the general use of cattle-dung as fuel, for the ashes made during the combustion of the dung are, as manure, quite as efficacious as the dung from which they were made. This is but an attempt to revive the old "mineral theory" which, about twenty-five years ago, was brought into considerable prominence by one or two Continental Chemists, who, though eminent in a knowledge of the results of researches conducted in the laboratory, were thoroughly ignorant regarding the processes of agriculture, and the bearing these had on the various physical agencies which aid the husbandman in his work. Agricultural chemistry was at that time but in its infancy, and it was not at all surprising, seeing what grand discoveries chemistry had already made in connection with agriculture, that Chemists should have rather over-estimated the aid they could afford to the Farmer. Amongst those who fell into this mistake was that eminent chemist Baron Leibeg, but he, in his later writings, fully repudiated the mineral theory as originally advocated by him, and brought his views into harmony with those of our English Chemists who had not confined their researches and observations to the narrow limits of the laboratory; there is, perhaps in the present day, not a single Chemist of any repute who would venture to assert that the fertility of land under regular cropping can be sustained by the use of mineral manures alone, that is, using the word "mineral" in the sense in which it was used in the original "mineral theory." The fact is that, even if we do return to our soils the *exact* kind and quantity of mineral foods found in the ashes of the different crops we produce, we will not succeed by these means alone in maintaining the fertility of our land. It would be as sensible to attempt to support a horse in good working condition on a daily pill containing the equivalent of the ash-constituents of a fair daily allowance of ordinary food, as to attempt to maintain the fertility of a soil by returning to it the *exact* quantity *only* of the ash constituents of the preceding crop. The fact is, bulk and dilution are, within certain limits, as essential for the utilization of a manure as of a food, and this is effected in the most perfect way possible by the organic combinations in which these minerals are generally met with in plants; hence, one reason of the superiority of farm-yard manure over ashes, though both may contain the same minerals and in the same proportion. But I have said enough on the "mineral theory;" the question is too large for discussion at greater length here, and the practice of the farmer in every civilized country has afforded ample evidence that the views now held by Agricultural Chemists regarding the original "mineral theory" are sound and accurate.

113. I believe that from the general use of cattle-dung as fuel in this country, our agriculture suffers most severely;—first, from the urine being always wasted when the solid excrements of cattle are collected for burning; second, from the entire destruction of those latent physical powers in the dung which, when it is used in the shape of farm-yard manure, come into operation and produce such beneficial effects on the physical state of a soil; third, from the loss of plant-food dissipated into the air during the combustion of the dung; and last, from so large a proportion of the ashes made being entirely wasted, and the fertilizing properties of the small proportion used as manure being in most instances seriously lessened by the careless way in which they are usually protected from rain during collection.

114. Of course, the fertilizing value of the urine of the ox will depend very greatly upon the nature of the food it consumes; but the following shows its approximate composition and, for comparison, that of the solid excrements also:—

—	Urine.	Dung.
Water	920	840
(*a*) Organic matter, urea, uric acid, &c.	60	135
(*b*) Inorganic matter, salts of potash, soda, &c.	20	25
Total ...	1,000	1,000
(*a*) Containing nitrogen capable of yielding ammonia	9·00	3·60
(*b*) Containing phosphoric acid	·70	2·25

115. It will be seen from this that the urine is very valuable; indeed, by many authorities it is considered the most valuable portion of the excrements of the ox; the loss to this country, then, from allowing this valuable fertilizing agent to run to waste to such a serious extent must be enormous.

116. It is a mistake to suppose that the fertilizing effects of farm-yard manure can be measured and determined by its composition as shown by analysis. Field experiments have proved over and over again, that one ton of farm-yard manure when applied to the soil will produce vastly greater effects than a dressing of a mineral manure containing the ash equivalents of the ton of manure; while the effect of the ashes on the physical state of the soil would be almost imperceptible, that produced by the farm-yard manure would be great and highly beneficial. In no country would the benefits that are conferred on a soil by an application of farm-yard manure be greater than in India, where famines so frequently result from a drought. The power of a soil to absorb moisture from the air, and to retain that moisture in a healthy condition, depends almost entirely upon the quantity and state of the organic matter that soil contains; but, with reference to this matter, I cannot do better than direct attention to the statements made by Dr. Voelcker, in a report printed in the last issue of the Journal of the Royal Agricultural Society of England on the analysis of seventy samples of drainage water collected by pipes, on the Rothamstead Experimental Farm, from plots which had each, for many years, been manured by one kind of manure only. Speaking of the plot that had continuously been manured with farm-yard manure, he says:—

"Notwithstanding the heavy and continuous rains which fell in December, and which caused the pipe-drains from all the other plots to run freely, little or no water passed through the drain-pipe from the plot usually manured with farm-yard manure, and, consequently, no analysis of the drainage from that plot could be made in December 1869. Dr. Gilbert informs me that whilst the pipe-drains from every one of the other plots (dressed with mineral manures) in the experimental wheat-field run freely, perhaps four or five times or more annually, the drain from the dunged plot seldom runs at all more than once a-year, and in some seasons not at all. The fact is the vast accumulation of decomposing organic matter on the plot, annually dunged at the rate of fourteen tons of farm-yard manure per acre, lightens the soil and promotes the disintegration of the clayey portions, and altogether renders the surface-soil more porous and capable of retaining much more water. Hence a much greater amount and continuity of rain is required before the porous surface is fully charged with rain, and an excess can reach the drains."

"This result is interesting and important, for it illustrates in a striking manner the beneficial effects of farm-yard manure on the soil in ameliorating its texture, and generally speaking, its mechanical or physical condition, in consequence of which the growing crops will suffer less during seasons of drought. Messrs. Lawes and Gilbert have found that the dunged soil, when saturated, retained within twelve inches of the surface an excess of water which would be equivalent to about 1½ inches of rain more than that held to the same depth on the unmanured and the artificially 'mineral' manured plots in the same field, which fully explains the circumstance that during the five collections of drainage waters, samples from the dunged plot could be obtained only on two occasions."

117. The direct waste of plant-food by burning dung is great, as the whole of the organic matter which constitutes at least 85 per cent. of dry dung, and which contains amongst other valuable plant-food a large percentage of nitrogen, the most costly and most difficult to replace of all these foods, is dissipated into the air and lost.

118. One of the greatest difficulties with which our Municipalities and Village Authorities have to contend is, the great accumulation of ashes (cow-dung and wood) in our towns and villages; in some instances there having been no other alternative, but to use these ashes in filling holes and other inequalities in the ground.

119. I can always buy for the Sydapet Farms any quantity of ashes—½ cow-dung and ½ wood-ashes—at one anna per cart-load in the village. During the past year, I purchased about 5,600 parahs equal to 480 cubic yards, at 30 parahs or about 6 Annas per cubic yard delivered on any part of the Farm where they were required.

120. I can also purchase *pure* cow-dung ashes at 25 parahs per rupee delivered; now deducting the cart-hire for three cart-loads Annas 9, we have the value of the ashes in the village, *viz.*, 25 parahs for Annas 7, equal to about 3½ Annas per cubic yard, as it takes about 150 pounds of perfectly dry dung to yield one parah of ashes, we arrive at the fact that in the manufacture of one cubic yard of the ashes 1,725 lbs. of dry dung or about 3,000 lbs. of fresh dung must have been used; however, fresh dung is never employed as manure by itself, it is, in all civilized countries, collected with the litter used in bedding, which, also, contains the urine of the animal, and the mass collected forms what is called farm-yard manure. Now, if instead of the 3,000 lbs. of fresh dung having been collected separately for use as fuel, it had been made into farm-yard manure, the quantity would have amounted to certainly not less than 7,000 lbs., or about twelve country cart-loads. I am quite sure that every one who is in the least qualified to form an opinion on the matter will agree with me that the twelve cart-loads of farm-yard manure would produce, when applied to the soil, at the least four times the effect in increased crop returns, that would be obtained from the use in a similar way of the cubic yard of cow-dung ashes. Not only would the immediate effect be greater, but it would continue to act over a much longer period. Again, while the ashes might be washed out of the soil and carried away by the first downpour of rain after their application, the farm-yard manure in the soil could not be removed in this way.

121. If it was necessary to provide food to sustain the people of this country during the famine, if it is necessary to improve the sanitation of the country in order to prevent the outbreak and spread of epidemic diseases amongst the people, and by these means remove the checks which previously existed on the increase of population, surely it is equally necessary to take means to ensure that this increased population can obtain sufficient food. It is of little use endeavoring to remove those causes which tended to keep down the population, if the people thus preserved are to be rendered miserable throughout life from their having to subsist on a semi-starvation diet. The universal practice of burning cow-dung lessens materially the food-producing powers of the country, and the practice, in most instances, is most unjustifiable. Every Ryot can, at a trifling expense, and at little trouble to himself, produce on his land the fuel required for the use of his household. If every Renter of Government land was compelled to grow a certain quantity of fuel trees for each acre occupied, the benefit to the country would be immense in the course of a few years, as cattle-dung would then be set free for use in a legitimate way, and not only would the produce of the land now under cultivation be increased, but much of the land abandoned might again be brought under profitable cultivation.

122. Whether it is good economy on the part of the town-people of this country to use dry cow-dung in the form of bratties for fuel is altogether another question, but I venture to think that it is not good economy, seeing that the selling price of a ton of dry dung is, in most instances, in excess of the selling price of firewood, and, at the least, double the price at which firewood could be produced in the neighbourhood of towns.

123. The following experiment was made to ascertain the quantity of ashes that would be obtained from the dung of two bullocks, and the quantity of fold-yard manure that would be made by other two bullocks, treated alike, during two months. All the bullocks were about the same in age and size, they were all worked during the day, and confined in sheds at night; they were fed on dry straw and cake; the experiment extended over two months, during which there was a great drought and an enormous evaporation; the inside temperature during the time varied between 95 and 105 degrees, and the entire rainfall during the period only amounted to 00·93 inches. Each bullock was confined in a loose-box under cover; in two of

the boxes no litter was supplied, and the solid excrements were removed daily and made into bratties or cakes ; these, after being thoroughly dried, weighed 189 pounds, and, after burning, yielded 56½ pounds ashes. The cattle in the other two boxes were bedded with 364 pounds of litter; this litter absorbed the urine of the animals, and with it were mixed the whole of the solid excrements ; the manure, thus made, was found to weigh, at the termination of the experiment, 586 pounds ; the weight would have been very much greater had there been green food available for the animals, or, had the experiment been made during ordinary weather, instead of during a drought ; as, owing to the extreme dryness of the air, the litter, in the manure, contained very little more moisture than when it was first put into the loose-box, its increase in weight being due chiefly to the dry matter of the urine it had absorbed, and which, weight for weight, is much more valuable than the dry matter of the solid excrements. This is the first of a series of experiments of the kind intended to be made at different seasons of the year and under different conditions.

124. *The Fern.*—The species to which the following remarks refer is the *Pteris Aquilina* generally known as the *bracken*, which is found abundantly in many parts of the higher hill ranges of this Presidency. The bracken is used as a litter for cattle stalls, &c., very largely by Coffee Planters resident on the Neilgherris, in Wynaad and in Coorg ; for this purpose it is well suited where the straw of cereals is costly and difficult to obtain. It is much slower in decomposing than ordinary straw, and its stem being solid instead of hollow, it is in the fresh state unable to take up much moisture, but the mass formed by decomposed ferns is quite as able as decomposed straw to take up and retain moisture. When used in cattle-boxes, the fern rots more readily than in ordinary byres ; it is used chiefly in the large open " crawls " in which buffaloes and hill cattle are confined at night. It is the practice with many Planters to erect these cattle-crawls at convenient distances from their estates, and to induce the hill people, by the payment of a small sum, to confine their cattle within them at night. These " crawls " are kept liberally bedded with ferns, grass, &c., which, under the treading of the cattle at night, aided by frequent rain, become broken up and worked into a black-colored mass ; this is a convenient and expeditious way of working up ferns, &c., into a form convenient for use as manure ; but I greatly doubt the wisdom of the practice, as, not only must there be a great loss of soluble fertilizing matters by the frequent washing by rain to which the manure is exposed, especially during the later stages of decay, but owing to the enormous absorption of rain water by the manure, the cost of conveying it to the coffee trees will be, at the least, twice as great as it should be.

125. The following is an average analysis of the composition of the ash of the bracken made by Professor Emil Wolff of the Royal Academy of Agriculture at Hohenheim, Wirtemberg ; and also, for comparison, an average analysis of wheat-straw by the same eminent chemist :—

	Bracken.	Wheat Straw.
Per cent of Ash	7·01.	4·95.
Composition of the ash—		
Potash	42·8	11·5
Soda	4·5	2·9
Magnesia	7·7	2.6
Lime	14·0	6·2
Phosphoric acid	9·7	5·4
Sulphuric acid	5·1	2·9
Silica	6·0	68·3
Chlorine	10·2	——
Total ...	100·	99·8

It will be observed in comparing these analyses that not only does the fern yield a much larger quantity of ash than wheat-straw, but that more than one-half of this ash consists of the highly valuable fertilizing minerals phosphoric acid and potash, both so essential in a soil on which coffee trees are growing. It will be further observed that the ash of the fern is twice as rich in lime as the ash of the wheat-straw. Of course, there is always a considerable difference in the composition of the ash of the same plant produced on different soils, or under different conditions as regards cultivation and manure. However, as the fern is generally found growing on uncultivated land, the composition of its ash is somewhat more uniform than that of the ash of cultivated plants, and I think, for all practical purposes, the analysis I have given may be accepted—until we are in possession of an actual analysis of our hill-produced ferns—as fairly approximating to the analysis of the ferns used by planters in the way I have described. The percentage of lime may be on the average somewhat less, but I do not think that there would be any appreciable difference in the percentage of the other constituents of the ash.

126. *Lime.*—As far as I have been able to ascertain, lime is not used as a manure in any part of Southern India; our Cultivators appear to be entirely ignorant of its fertilizing qualities. Seeing how universally the value of lime, as a manure, is acknowledged by Agriculturists in almost every other part of the world, it is but little to the credit of Indian Cultivators that they should have remained so long in ignorance regarding a manure which enters so largely into the food of all cultivated plants. It is true that in many localities in this Presidency, the price that must be paid for lime is twice as great as the average cost of lime to the British Farmer; but the neglect with which lime has been treated by our Cultivators is certainly not due to its costliness, for in districts where it can be obtained more readily and at less expense, its use as a manure is equally neglected. The various experiments made on the Sydapet Farms in the use of lime as a manure have proved conclusively its value, especially for such crops as indigo, cotton, maize, tobacco, &c. But the light soils of the Sydapet Farms are not so well adapted for exhibiting the benefits derived from a dressing of lime as soils which contain a larger proportion of clay and vegetable matter. There are soils on these Farms peculiarly suited to benefit from an application of lime, but full advantage could not be derived from such a dressing until, by sub-soil draining, they have been rendered less swampy than they now are at certain seasons. I have used dressings of, from 10 cwts. to 20 cwts. per acre, spread broadcast over the soil, and I find that not only does the lime supply the peculiar food needed by our principal field crops, but it tends to render our light soils more compact, and makes them more capable to withstand the ill-effects of a long drought. The high price of lime at Sydapet prohibits its use in such dressings as in England are usually applied at one time; but even if lime was procurable on more reasonable terms for the Sydapet Farms, it would not, I think, be advisable to apply it in heavy dressings to the light soils, of which they chiefly consist; with such soils, it is I think best to apply light dressings of, say, 20 cwts. per acre at intervals of three or four years, instead of, as is usual in England, applying from 6 to 9 tons in one application at intervals of about fifteen years.

127. Lime forms the chief constituent of the ash of most plants cultivated in the field. All fertile soils contain a greater or less quantity of lime. Not only does lime afford the food needed by our crops, but by its action in the soil it sets free mineral food which was previously inert and of no use to growing crops. Lime, when applied to a soil, has other valuable properties in addition to those already noticed; it removes the acidity of a sour soil; it hastens the decomposition of animal and vegetable substances; as a dressing for heavy clay or recently exposed soil, it is invaluable in its mellowing influences; and, when applied to soils on which fruit trees are growing, it has a wonderful effect for good on the quality and flavor of their produce. A piece of ground of stiff tenacious clay, on the Experimental Farm on which the plantain trees yielded a coarse fruit, almost uneatable, was dressed with lime, after which there was a remarkable change in the quality of the fruit, not only was the flavor all that could be desired, but the skin, which before was coarse and woody, became very thin and fine, and separated easily from the edible portion.

128. It is perhaps as well, all things considered, that our Ryots should have been so ignorant regarding the action of lime on the soil; while lime in the hands of an intelligent Farmer is one of the most valuable manures that can be used, it is very unsafe in the hands of ignorant improvident Cultivators, as by its aid they are able to exhaust a soil very rapidly of its fertilizing ingredients. Soils which may for a long period continue to yield crops such as our Ryots now produce would, if deeply ploughed and dressed with lime, without the aid of other manure, yield very much larger returns, for a time, but the after effects would be that the soil would become less and less productive: the increased return produced by the lime, in addition to its own direct supply of food, being due to its action on the mineral constituents of the soil which were before either entirely inert, or only sufficiently active to supply the wants of the small crops previously produced. Of course, the object of the Farmer is to keep the mineral food in his soil in as active a state as possible. In good farming, the practice is to turn over this food, frequently and rapidly, by producing large crops in quick succession, but to enable this to be done, manure of the right quality and in proper quantities must be used freely in addition to lime, it is rather as a manure for use under high farming that lime is to be recommended to the Farmer; and while it is to be regretted that the conditions met with in the practice of agriculture in this country are not yet such as to render it advisable that our Ryots should be encouraged to use lime freely, the time is, I hope, not far distant when it may be safely recommended to their notice.

Sub-soil draining.

129. My remarks in a former report on sub-soil draining have, in some instances, been misunderstood, evidently from a want of knowledge of what sub-soil draining really means. When making those observations I thought it unnecessary to describe in detail the way in which pipe-drains act, seeing that so much has been written on the subject. It has been contended by some that, if water is so essential for the proper growth and development of field crops in Southern India, that it will be exceedingly unwise to attempt to lessen the quantity of this element in our soils. It must be remembered that no description of sub-soil drains can remove from a soil the whole of the moisture it contains, there is always even in the most perfectly drained land a considerable quantity of water which no drainage can remove. It has been found again and again that a well-drained soil contains during a drought more moisture than an undrained soil of similar character and composition; there are many reasons why this is so; drainage facilitates the working of a soil by field implements, not only in the greater perfection of the work done, but in affording a longer season in which to do the work under favorable conditions, and as a thoroughly-tilled soil is always well pulverised and therefore more porous, its capabilities to retain water by suspension are greatly increased, as well as its abilities to absorb moisture from the air. A proper seed-bed cannot be obtained in a soil in which there is too much water; for the germination of seed and the healthy growth of plants, atmospheric air must be present in the soil, and this cannot be there in a sufficient quantity when the soil is full of water. Further, a water-logged soil is always cold, not only on account of the great reduction of temperature caused by the evaporation of its water, but also because heat cannot penetrate into it. Tropical plants suffer very much when the temperature of the soil on which they are growing becomes too greatly reduced. During the prevalence of the north-east monsoon in this district, when we have had a succession of wet days with a clouded sky, I have frequently observed crops turn sickly and yellow, which previously were very healthy in appearance; and such crops seldom did well after their growth was checked in this way, as they were generally afterwards attacked by the fungoid disease "rust." I have not yet had an opportunity to make any experiments regarding the temperature of the soil at such times, but I believe that the check in growth is due almost entirely to the low temperature of the soil, as the crops growing on the drained land remained green and healthy.

130. There are, of course, soils that do not require to be artificially drained, being sufficiently well drained naturally; I only advocate the removal by sub-soil drainage, of water the land will not hold in suspension, or the water of springs immediately under cultivated land.

131. Soils differ greatly in their capacity to hold water in mechanical suspension; thus it has been found that —

100 lbs. of quartz-sand	will absorb	25 lbs. of	water.
,, of calcareous sand	do.	29 lbs. of	do.
,, of loamy soil	do.	40 lbs. of	do.
,, of English chalk	do.	45 lbs. of	do.
,, of clay loam	do.	50 lbs. of	do.
,, of pure clay	do.	70 lbs. of	do.

132. The pipes used in sub-soil draining should be placed for carrying off surplus water at a depth sufficiently great to allow of the upper soil forming a hugh filter bed, to which the rain water in passing through would give up the fertilizing matter and air it holds. Messrs. Laws and Gilbert, the eminent chemists, have found in England that in a rain-fall of thirty inches in one year, the rain-water that fell on an acre of land carried down with it as much as 7 lbs. of ammonia, which is equal to the quantity contained in a dressing of manure frequently thought sufficient for the wants of one crop.

133. In a hot country such as this, sub-soil ploughing and other deep cultivation are absolutely necessary in order to secure the full benefits that result from sub-soil draining. A soil that is simply drained, the particles of which are not separated and loosened under the influences of deep cultivation, cannot in a dry season be expected to take up more moisture from the atmosphere, than undrained land of the same kind in a similar mechanical state. The absorption of moisture from the air can only occur in porous soils into which the air can pass freely; sun-dried, hard, compact soils are quite incapable of absorbing moisture from the air. As in this country, at night, the air near the surface of the ground is at certain seasons so heavily charged with moisture, it is especially necessary, in order to secure this moisture, that our soils should be kept as open and as porous as possible.

Implements and Machines.

134. The following new implements and machines were imported from the United States during the past year ;—

135. *Cast-Iron Plough.*—This is a small plough to be drawn by a single horse or mule, and is intended for use in cotton culture. The working parts of the plough are made of cast-iron, and its stilts and beam of wood. The cash price in New York was 3 dollars 38 cents, and its cost delivered at the Sydapet Experimental Farm was only 10 Rupees. The plough is unfortunately faulty in construction ; its mould-board is set nearly at right angles to the beam, thus causing the draught to be very heavy; and the slade is so short, the plough moves very unevenly through the soil, in places going so deeply that it becomes embedded and fixed ; by placing a wheel under the beam the latter drawback would no longer be experienced, and a slight alteration in the position of the mould-board would greatly reduce the draught. The cast-iron working-parts, also, are objectionable ; they are so liable to be broken when in use by coming into contact with stones or the roots of trees. Implements that are fitted with working-parts made of cast-iron are not yet suited for general use in this country ; much annoyance and loss have already been experienced from the purchase of such implements.

136. A plough of the kind under notice could readily be made with wrought-iron working parts and with a wheel, but the cost would be 50 per cent. greater than the price of the unimproved plough.

137. The following shows the results of an experiment made with this plough :—

Weight of Plough.	Draught registered.	Work done.		
		Depth of Furrow.	Width of Furrow.	Earth removed in 100 yards length of Furrow.
Pounds.	Pounds.	Inches.	Inches.	Cubic yards.
34	448	9·00	13·53	9·39

The soil had been recently stirred and was free and open. Nine and-a-third cubic yards for every one hundred yards of furrow is about double the amount of work usually performed by our ploughs, and is, I think, beyond the strength of the plough when in regular work, while the draught required to do so much work is too great for an ordinary pair of cattle.

138. *Steel Plough.*—This plough is similar in general apparance to that, to which I have just referred, but differs from it in having a steel mould-board with polished cast-iron share and land side, while its mould-board is less abrupt. The cash price of this plough in New York was 6 dollars and 30 cents, and its cost delivered at the Sydapet Experimental Farm was Rupees 18. The following is the result of an experiment made with this plough :—

Weight of Plough.	Draught registered.	Work done.		
		Depth of Furrow.	Width of Furrow.	Earth removed in 100 Yards' Length of Furrow.
Pounds.	Pounds.	Inches.	Inches.	Cubic Yards.
45	280	7·	11·	5·94

This experiment was made at the same time as that previously noticed and under similar conditions ; it will be observed that for the draught absorbed the result was better than that obtained with the cast-iron plough. The plough under notice possesses, though in a lesser degree, most of the faults to which I alluded when referring to the cast-iron plough. Steel mould-boards are considered to be much more durable than those that are made of cast iron, while, as the soil adheres less readily to polished steel, the draught of ploughs fitted with these mould-boards is lighter than that of ploughs fitted with ordinary mould-boards.

139. *Maize Sheller.*—Specimens of three kinds of maize shellers were obtained : single-wheel sheller, double-wheel sheller, and eagle sheller. The first and second differ only in the number of wheels each has ; they are intended for ordinary light work with manual power. The eagle sheller is a stronger and larger description well suited for continuous and heavy work. The single-wheel sheller cost in New York 9 dollars and 90 cents, and delivered at the Experimental Farm Rupees 27 ; the double wheel sheller cost delivered each Rupees 3 more. The cost of the eagle sheller delivered at the Sydapet Experimental Farm was Rupees 40 ; its price in New York was 14 dollars and 40 cents. These are all very useful machines ; each of them is capable of doing a large amount of work, and at a cost far below that usually incurred in this country for shelling maize.

140. *Winnowing Machine.*—This is a very handy little machine, and is well suited for the use of Ryots having more than 30 acres of arable land. Its cost delivered at the Experimental Farm was only Rupees 45.

141. *Chaff Cutters.*—Two specimens of the variety known as the national feed-cutter were obtained. Their knives are fixed obliquely on a cylinder ; they cut with great rapidity the thick stalks of maize, cholum, &c., as well as the finer grasses. The cost of these machines delivered at the Experimental Farm was Rupees 45 each. They are greatly superior in every way to machines fitted with ordinary vertical cutting knives, and their cost is not greater.

MODEL FARM.

142. In my last annual report I stated in detail the circumstances under which this farm was begun ; it is therefore unnecessary here to do more than mention that the land, when appropriated for the purposes of this farm, was in a most wretched condition, having been completely ruined, and then abandoned, by the Native Cultivators in whose hands it had been. The close proximity of land in this wretched state to the Experimental Farm was considered very objectionable, and the Committee, who at that time had control over the farm, thought, and I thought the same, that, if the land was taken up and worked as a Model Farm, it might be improved in appearance and in value, and a fair return be obtained on the outlay. The results of the experiment so far amply justify the opinions then formed, as far as relates to an improvement in the appearance and value of the land, but I am now convinced that it was *a mistake to begin*

an experiment to test the financial results of improved farming on land so much out of order as that taken up. It is a very different affair to open up a farm on fresh land, or land that has been fairly cultivated, than it is to establish a farm, and to work it on a good system, on a piece of worn-out land with a surface excavated and broken up in all directions.

143. The condition of the soil as regards productiveness proved to be very much lower than had been anticipated. There were a few small plots scattered over the farm on which trees had been growing that produced moderately good crops; but over fully two-thirds of the area the soils did not on the average produce 5 bushels of grain per acre and some of the land did not yield even half this quantity, while the broken surface rendered it impossible to work improved implements with any chance of success.

144. During the first two or three years after the farm was started, the surface of the land was restored to something like its natural state, but my time was then so fully occupied, and, having no one available to superintend the work, I was unwilling to expend more money in levelling the land than was absolutely necessary to admit of the proper working of improved implements and machines, but this limited improvement was altogether insufficient to secure a return that we had a right to expect from the greater care devoted to the cultivation of the land. When we succeeded in bringing a crop to maturity under satisfactory conditions, the result was very encouraging, but from their unfrequency these better crops contributed but little to the general income of the farm. The crops generally continued to be almost as precarious as when the land was first taken up. From the effects of floods and droughts not more than one sowing in every four or, five reached maturity. The interest and other charges on the cost of these *partial* improvements formed a heavy and accumulating burden against the farm without, as just noticed, producing any results of a corresponding value.

145. I was not long in forming the opinion that, before we could hope to secure satisfactory financial results from farming the land on a moderately good system of husbandry, it was necessary to complete fully, and with as little delay as possible, the improvements contemplated, for, though the immediate expense would be great, it would perhaps not be greater than if the improvements were effected gradually. Accordingly in the beginning of the last official year, the services of an Assistant being then avaliable, and the showery weather enabling earthwork to be done at a very moderate cost, I engaged a large gang of laborers and pushed forward with vigor the work needed to be done in levelling the land; this was continued throughout the summer months and until the commencement of the north-east monsoon. The work, of course, interfered greatly with the cropping of the farm and seriously lessened the income of the year, but the diminished income of the farm is far more than counterbalanced by the increased value of the estate for, the weather continuing showery throughout the whole period, the improvements were effected at a very moderate cost.

146. The surface of the land is now almost all that could be desired; heavy rains, which previously cut up and rutted the sandy soils and carried off the manure which had been applied, now do but very little damage, a greater portion of the water passing into the soil and that unabsorbed running away into surface drains. This general improvement in the lay of the land, with the provision of surface drains, has done much to prevent the accumulation of stagnant water especially in the irrigated land, but the portion of this and of the dry land liable to be submerged during floods of the river Adyar needs further attention, probably subsoil drainage will be necessary in order that the land when saturated after the floods may be speedily relieved of stagnant water. Unfortunately the portion of the farm thus circumstanced is the best part, and, as the floods generally occur in October or the beginning of November, little can be done in cropping the land until the beginning of December, when the floods are over, and in three years out of every four cereal crops sown so late never reach full maturity unless occasionally irrigated, and water is available only for a few acres of this land and frequently only up to the end of February, when the late-sown crop is but two-thirds grown.

147. But, before good results can be regularly secured from the working of this farm on a moderately good method, it is necessary, not only to lessen the ill-effects of the floods of the Adyar, but it *is absolutely needful that a plentiful and certain supply of irrigation water should be secured over the greater portion of its surface.* Under present circumstances the area that can be watered is very small, and the supply of water seldom lasts more than four months, generally ceasing just when it is most urgently needed to bring the crops to maturity.

148. A small tank, the water of which enabled the crops to be sown on a considerable area of the wet land somewhat earlier than would have been possible if the ordinary irrigation source was relied on, and which proved of great use in maturing crops after the irrigation source had failed, was last year taken from the farm and given over to the charge of another department, and, the loss caused thereby last year was great, as a large area of paddy on the ground that was flooded in the early part of the season by the river altogether failed from there being no water to bring it to maturity ; had the farm had the use of the tank as in former years, this loss would not have occurred.

149. Good farming demands that means must be at command to lessen the ill effects of droughts and floods, and that the work of the farm must progress with some degree of uniformity throughout the year. In the case of this farm, as already pointed out, the crops suffer both from droughts and from floods; and, from the absence of a continuous supply of irrigation water, the real work of the farm is limited to a period of not more than five months in the year. This, in the case of a Ryot would have mattered but little, as, during the inactive period, he would entirely suspend all expenditure and leave his draught cattle to exist on such scanty food as they could collect on the road sides and other waste places. But such a course could not be followed on a Public Farm, which must be kept in good order, under any circumstances, throughout the year. The outlay on this farm during this inactive period last year amounted to not less than Rupees 1,500, which was practically unremunerative expenditure and which should not fairly be debited in an experiment of a *commercial* nature. Hence the necessity of the farm being provided with water to enable its cultivation to be conducted throughout the year, and in this way, while keeping up its condition, produce a remunerative result on the labor thus expended. But the fact is, a Public Farm never can be conducted on *strictly commercial principles* ; there is always, even on farms in good cultivation, a large amount of work of a semi-ornamental kind to be done, which produces no direct return, and the amount of this description of work on a farm in the course of formation is necessarily greater.

150. The balance sheet on the 31st March 1875 was as follows :—

LIABILITIES.

	RS.	A.	P.
Loan from General Funds for 1870-71	2,776	9	10
Do. do. 1871-72	1,310	3	11
Do. do. 1872-73	1,772	2	2
Do. do. 1873-74	1,522	13	8
Do. do. 1874-75	3,082	9	8
Laborers' pay due for March 1875	187	1	5
Outstanding bill	31	7	6
Total ...	10,683	0	2

ASSETS.

Cattle.						
15 Working cattle...	900	0	0			
Sheep.						
15 Rams 29 Ewes 6 Wethers 15 Lambs	320	0	0			
Poultry	60	0	0	1,280	0	0

				RS.	A.	P.
	Implements.					
	Implements, tools, carts, &c., as catalogued			861	8	10
	Manures.					
	Manure of sorts	45	0	0		
¼	Cost of manure purchased in 1873-74	10	5	11		
¼	Cost of cake purchased in 1873-74	132	15	9		
½	Cost of manure purchased in 1874-75	231	3	0		
½	Cost of cake purchased in 1874-75	268	14	7		
					688	7	3
	Fruit and Fuel Trees, &c.					
	Cocoanut and mango trees, Casuarina trees, Guava trees				1,350	0	0
	Fruit crops				450	0	0
	Field Crops.					
	Grain and pulse crops, Guinea grass, Fodder crops of sorts				400	0	0
	Seeds, &c., in Granary.					
175	Pounds of Carolina paddy	5	13	4		
775	Do. sumba paddy	15	8	0		
7	Do. green gram	0	5	1		
15	Do. horse gram	0	6	4		
27	Do. yellow cholum	0	10	10		
521	Do. cumboo	26	0	10		
87	Do. maize	4	5	7		
10½	Do. indigo seed	1	0	0		
22½	Do. wool	3	8	3		
27	Do. cotton in seed	2	4	0		
					59	14	3
	Sundries				60	0	0
	Cultivations done for next season's crop				75	0.	0
	Uncollected bills				481	3	0
	Difference, being balance against the farm				4,976	14	10
	Total ...				10,683	0	2

151. The following are the details of Income and Expenditure during the past year :—

Expenditure.	RS.	A.	P.
Rent and interest...	913	1	6
Overseer's salary	647	8	0
Labor	1,589	12	4
Cattle	25	0	0
Pigs	168	14	10
Sheep	135	2	0
Poultry, rabbits, &c.	4	12	6
Implements, machines, and tools	334	1	4
Seeds	182	10	1
Cattle food	537	13	2
Manure	462	6	0
Sundries	56	3	7
Total ...	5,057	5	4

* Consists chiefly of debts due by the Estate.

Income.	RS.	A.	P.
Advance from General Funds	3,082	9	8
Cattle	85	0	0
Pigs	344	0	11
Sheep	132	3	5
Poultry, rabbits, &c.	84	1	0
Fruits, plantain, and vegetables...	568	2	11
Grains, fodder, &c.	408	3	7
Indigo, cotton, and sundries	352	15	10
Total ...	5,057	5	4

Expenditure from commencement of the Farm up to and including the 31st of March 1875.

Items.	*1870-71.			1871-72.			1872-73.			1873-74.			1874-75.			Total.					
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cooly labor...	1,105	4	2	1,375	9	11	1,369	14	0	1,317	1	11	1,589	12	4	6,757	10	4			
Manure	3	0	0	71	1	4	185	2	7	41	7	7	462	6	0	763	1	6			
Live stock	1,641	15	0	731	6	8	636	3	0	252	10	3	333	13	4	3,596	0	3			
Food for live stock	267	11	9	557	7	3	506	3	11	531	15	1	537	13	2	2,401	3	2			
Seeds, trees, &c.	194	1	7	91	6	7	153	9	2	122	13	5	182	10	1	744	8	10			
Implements, tools, &c.	461	9	0	18	13	0	277	8	6	67	5	0	334	1	4	1,159	4	10			
Contingencies	74	4	9	100	2	3	16	6	9	16	10	2	56	3	7	263	11	6	15,685	8	5
Overseer's salary	113	12	0	370	0	0	600	0	0	610	0	0	647	8	0	2,341	4	0			
Rent	192	8	0	385	0	0	385	0	0	385	0	0	385	0	0	1,732	8	0			
Interest on capital employed in working the farm...	69	8	4	150	0	0	200	0	0	200	0	0	200	0	0	819	8	4			
Interest on capital expended on improvements of a permanent character	94	6	7	296	1	8	328	1	6	328	1	6	328	1	6	1,374	12	9	6,268	1	1
																Total...			21,953	9	6
																Unpaid bills...			218	8	11
																Total...			22,172	2	5

* Half-year.

Income from commencement of the Farm up to and including the 31st of March 1875.

Items.	*1870-71.			1871-72.			1872-73.			1873-74.			1874-75.			Total.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cattle	403	1	9	560	14	9	371	15	0	419	7	5	85	0	0	1,840	6	11
Sheep	...	...	...	141	10	6	237	2	6	188	10	9	132	3	5	699	11	2
Pigs	...	...	...	263	14	0	664	5	9	390	11	6	344	0	11	1,663	0	2
Poultry, rabbits, &c.	12	6	0	97	8	0	203	4	0	65	2	10	84	1	0	462	5	10
Fruits, plantain, and vegetables, &c....	474	12	6	582	10	3	444	1	6	290	1	11	568	2	11	2,359	13	1
Hay, green fodder, &c...	42	8	0	256	6	0	484	13	6	238	11	3	150	1	10	1,172	8	7
Grains	407	0	10	705	9	3	178	11	2	411	5	7	258	1	9	1,960	12	7
Indigo and cotton	...	...	...	...	...	...	...	...	...	232	12	6	7	8	0	240	4	6
Sundries	101	10	3	228	4	0	301	9	10	113	3	6	345	7	10	1,090	3	5
Total...	1,441	7	4	2,836	12	9	2,885	15	3	2,350	3	3	1,974	11	8	11,489	2	3
Add the valuation of the assets on the 31st of March 1875																5,706	1	4
Total...																17,195	3	7

* Half-year.

152. The actual results of the experiment are not fully brought out in the financial statements just given, much of the balance standing against the farm being for expenditure incurred for work which, though not exactly estate work, was fairly debitable against the estate, not being directly remunerative to the farm, though necessary for its successful working and to enable it to pay rent. Besides this the whole time of the Farm Overseer, who carried on the estate improvements, is debited against the farm, and there are other items which might be credited to the farm, such as up-keep of roads used by visitors, the value of the tank, the charge of which was taken from the farm last year, and given over to the charge of the Collector of Chingleput, for the use of his office establishment, &c.

153. All things considered, it would perhaps be the fairest way of now dealing with the experiment to consider the balance against the farm as expenditure on behalf of the landlord to be dealt with as with other expenditure on permanent improvements, to push on energetically to completion the whole of the contemplated improvements, and at the end of the present year, if these improvements are then completed and the farm amply supplied with irrigation water, to have the whole of its soils valued by the Settlement Department, the rent thus fixed to be the ultimate rent of the farm *without any other charge.* It might be that the rent fixed by the Settlement Department would represent but a small percentage on the total capital sunk on permanent improvements, but it must be remembered that expenditure incurred in bringing back into cultivation a worn-out exhausted arable soil is seldom directly remunerative.

IMPLEMENT WORKSHOPS.

154. The income of these workshops during the past year amounted to Rupees 2,243-11-9 and the expenditure on their behalf was Rupees 2,120-12-0.

155. There was a balance against the workshops at the end of the official year 1873-74, amounting to Rupees 540-0-4, which at the close of the year under review had been reduced to Rupees 424-15-8.

156. These workshops supplied during the year thirteen combined ploughs, seven iron ploughs, three maize shellers, one chaff cutter, one drag harrow, and a number of smaller implements and tools besides doing all the repairs needed by the implements, machines, &c., used on the Sydapet Farms. The following shows where these implements, &c., were sent :—

Province or District.	Combined Ploughs.	Iron Ploughs.	Maize Shellers.	Chaff Cutters.	Drag Harrow.
Burmah	1	...	...	...	...
Cochin	...	1	...	...	...
Coimbatore	...	2	...	1	...
Madras	2	1	...	...	1
North-Western Provinces..	7	...	...	..	...
Nilgiris	2	1	...	...	...
Port Blair...	...	...	3	...	...
Travancore	1	1	...	...	...
Trichinopoly	...	1	...	...	...
Total ...	13	7	3	1	1

157. At the close of the year there remained several registered applications for machines and implements.

The following are the details of income and expenditure during the past year :—

Income.

	RS.	A.	P.
Machines, &c.	792	4	6
Labor, materials, &c.	1,451	7	3
Total ...	2,243	11	9

Expenditure.

	RS.	A.	P.
Buildings	9	15	0
Plant	23	10	0
Cooly labor, &c.	1,025	4	3
Materials, &c.	931	14	9
Interest on capital	130	0	0
Total ...	2,120	12	0

Implement Workshops' Balance Sheet on the 31st March 1875—

Liabilities.

Loan from General Funds for 1870-71			883	1	5
Do. do. 1871-72			213	1	2
Do. do. 1872-73			1,077	3	2
Outstanding bills			142	2	0
Laborers' pay due for March 1875			94	10	0
			2,410	1	9
Deduct capital returned by excess of income over expenditure during 1873-74	213	10	5		
Deduct capital returned by excess of income over expenditure during 1874-75	122	15	9		
			336	10	2
Total ...			2,073	7	7

Assets.

Buildings	419	15	3
Plant	321	1	6
Materials	251	12	2
New implements, machines, &c., in stock	352	0	0
*Outstanding bills...	303	11	0
Deficiency	424	15	8
Total ...	2,073	7	7

Establishment.

158. I have received much valuable aid from my Assistants Mr. Charles Benson, M.R.A.C., and Mr. Kaspar Schiffmayer. During my absence from duty for three months last year on privilege leave Mr. Benson had charge of my office, and Mr. Schiffmayer had charge of the working of the Sydapet Farms. There is nothing in the conduct of the Overseers, Clerks, or Apprentices that needs special notice here; all have performed their respective duties in a satisfactory way.

SYDAPET, (Signed) W. R. ROBERTSON, M.R.A.C.,
11th September 1875. Superintendent of Government Farms.

* Since collected.

APPENDICES.

Rain-fall registered at the Experimental Farm during the year ending 31st March 1875.

April 1874.	May 1874.	June 1874.	July 1874.	August 1874.	September 1874.	October 1874.	November 1874.	December 1874.	January 1875.	February 1875.	March 1875.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1... ...	1... ...	1... ...	1	1 ... 2·55	1	1	1	1	1	1... 0·77
2	2	2... ...	2... ...	2	2 ... 0·34	2	2	2	2	2	2... ...
3	3... ...	3... 1·60	3... ...	3	3 ... 0·47	3	3	3	3	3	3... ...
4	4... ...	4... 0·63	4... ...	4	4	4	4	4	4	4	4... ...
5	5... 5·80	5... ...	5... ...	5	5 ... 0·53	5 ... 1·15	5	5	5	5	5... ...
6	6... 0·71	6... ...	6... 0·84	6 ... 0·45	6 ... 0·54	6	6 ... 0·40	6	6	6	6... ...
7	7... ...	7... ...	7... ...	7	7 ... 0·53	7	7	7	7	7	7... ...
8	8... ...	8... 2·45	8	8	8	8	8	8	8	8	8... ...
9	9... ...	9... 0·25	9... 0·82	9	9	9	9 ... 1·00	9	9	9	9... ...
10	10... ...	10... ...	10... ...	10 ... 0·29	10 ... 2·38	10	10	10	10	10	10... ...
11	11... ...	11... ...	11... 0·62	11 ... 0·25	11	11	11	11 ... 0·77	11	11	11... ...
12	12... ...	12... ..	12... ...	12	12	12	12	12 ... 2·30	12	12	12... ...
13	13... ...	13... ...	13... 0·14	13	13	13	13	13	13	13	13... ...
14	14... ...	14... ...	14... ...	14	14 ... 0·44	14	14	14 ... 1·50	14	14	14... ...
15	15... ...	15... 0·42	15... ...	15	15	15	15	15 ... 0·44	15	15	15... ...
16	16... ...	16... ...	16... ...	16	16	16 ... 2·99	16	16	16	16	16... ...
17	17... ...	17... ...	17... 0·33	17	17	17	17 ... 0·10	17	17	17	17... ...
18	18... ...	18... ...	18... 1·78	18 ... 1·10	18 ... 0·50	18	18 ... 0·25	18	18	18	18... ...
19	19... ...	19... ...	19... 0·15	19	19	19 ... 0·24	19	19	19	19	19... ...
20	20... ...	20... ...	20... ...	20 ... 0·25	20	20	20	20	20	20	20... ...
21	21... ...	21... ...	21... ...	21	21	21 ... 0·83	21	21	21	21	21... ...
22	22... ...	22... ...	22... ...	22	22	22 ... 1·09	22	22	22	22	22... ...
23	23... ...	23... ...	23... ...	23	23 ... 0·43	23 ... 2·86	23	23	23	23	23... ...
24	24... ...	24... ...	24... ...	24	24	24 ... 7·67	24	24	24	24	24... ...
25	25... ...	25... ...	25... ...	25	25	25 ... 3·41	25	25	25 ... 0·10	25	25... ...
26	26... 0·28	26... ...	26... ...	26	26	26 ... 1·39	26 ... 1·06	26	26	26	26... ...
27	27... ...	27... 0·22	27... ...	27	27	27 ... 0·28	27 ... 3·06	27	27	27	27... ...
28	28... ...	28... ...	28 .. 0 78	28	28 ... 0·69	28	28	28 ... 0·10	28	28	28... ...
29	29... ...	29... 1·09	29... ...	29	29 ... 1·19	29	29	29	29	...	29... ...
30	30... ...	30... ...	30... ...	30	30	30	30 ... 3·38	30	30	...	30... ...
	31... ...		31... ...	31		31		31	31		31... ...
Total...None.	Total.6·79	Total.6·66	Total.5·46	Total ...2·34	Total...10·59	Total...21·91	Total... 9·25	Total... 5·11	Total...0·10	Total None.	Total 0·77

Expenditure on account of the Madras Agricultural Department.

	RS.	A.	P.	RS.	A.	P.
I. *General Supervision.*						
Establishment *	16,872	1	5			
Travelling allowance	1,048	4	5			
Contingencies	270	3	2			
				18,190	9	0
II. *Madras Experimental Farm.*						
Establishment	989	10	11			
Cooly labor	3,000	12	11			
Implements and machines	917	2	9			
Live stock	244	11	4			
Seeds	418	9	0			
Food for live stock	1,696	5	4			
Manure	380	8	1			
Despatching seeds	153	3	0			
Contingencies	355	2	8			
				8,156	2	0
III. *Madras Model Farm.*						
Establishment	647	8	0			
Cooly labor	1,589	12	4			
Manure	462	6	0			
Live stock	333	13	4			
Food for live stock	537	13	2			
Seeds	182	10	1			
Implements, carts, and water-lifts	334	1	4			
Rent and interest	913	1	6			
Contingencies	56	3	7			
				5,057	5	4
IV. *Implement Workshops.*						
Carpenters, smiths and filer	768	13	6			
Cooly labor	261	13	9			
Machines, implements, and materials	960	0	9			
Interest on capital	130	0	0			
				2,120	12	0
V. *Educational.*						
District Farm Apprentices	1,157	5	8			
Sydapet do. do.	1,353	5	10			
Schoolmaster for laborers' children	81	8	9			
Books, &c., for library	48	13	0			
Analytical laboratory	280	6	4			
Contingencies	88	8	5			
				3,010	0	0
VI. *Estate Improvements of a Permanent Character.*						
Repairs to buildings, &c.	803	5	5			
Re-thatching cattle shed at Model Farm	108	1	3			
Constructing field roads and repairs to similar roads ...	434	14	0			
Water channels	379	11	4			
Deepening wells	23	10	0			
Sub-soil and surface drainage	627	10	7			
Trees and planting	135	0	0			
Levelling and reclaiming land on the banks of the river ...	166	15	0			
Levelling the surface of dry crop land brought under wet cultivation, &c.	1,942	11	7			

* Includes salary of the Assistant to be placed in charge of the Coimbatore District Farm.

	RS.	A.	P.	RS.	A.	P.
Re-gravelling road at Model Farm	150	15	10			
Contingencies	83	3	6			
				4,856	2	6
Total ...				41,390	14	10

INCOME OF THE MADRAS AGRICULTURAL DEPARTMENT.

Balance on hand as per Accountant General's Books ...	1,75,975	14	7			
Special Grant	25,000	0	0			
Receipts from the Surplus Pound Fund during 1874-75 ...	56,756	6	9			
				2,57,732	5	4
I. *Madras Experimental Farm.*						
Fruits, vegetables, &c.	136	9	1			
Fodder, &c.	45	5	7			
Rent, &c.	1,446	11	5			
Cattle	27	4	0			
Pigs	227	2	4			
Sheep	261	4	0			
Poultry, rabbits, &c.	78	10	0			
Grains, seeds, &c.	492	6	10			
Indigo and cotton	84	11	8			
Machines, &c.	111	10	9			
Sundries	698	2	8			
				3,609	14	4
II. *Madras Model Farm.*						
Fruits, vegetables, &c.	568	2	11			
Fodder, &c.	150	1	10			
Cattle	85	0	0			
Pigs	344	0	11			
Sheep	132	3	5			
Poultry, rabbits, &c.	84	1	0			
Grains, seeds, cotton, &c.	265	9	9			
Sundries	345	7	10			
				1,974	11	8
III. *Implement Workshops.*						
Machines	792	4	6			
Materials, labor, &c.	1,451	7	3			
				2,243	11	9
Total ...				2,65,560	11	1
Balance in favor of the Madras Agricultural Department on the 1st of April 1875				2,23,405	2	3

VALUATION of Live and Dead Stock belonging to the Sydapet Experimental Farm on the 31st of March 1875.

	RS.	A.	P.	RS.	A.	P.
Cattle—						
5 Bulls						
18 Bullocks	...	...	...	1,485	0	0
1 Cow						
2 Calves						
Sheep—						
24 Rams						
59 Ewes	...	...	...	883	0	0
32 Gimmers						
53 Lambs						
Pigs—						
8 Boars						
13 Sows	...	...	...	429	0	0
2 Geldings						
3 Young Pigs						

	RS.	A.	P.	RS.	A.	P.
Poultry ...				60	0	0
Manures.						
Manure of sorts				200	0	0
Growing Crops.						
Gram, paddy, raggi, &c.	150	0	0			
Cotton	75	0	0			
Castor-oil	25	0	0			
Sugar-cane, brinjals, and plantains	500	0	0			
Fruit trees	60	0	0			
Casuarina and cocoanut trees	150	0	0			
				960	0	0
Farm Seeds, &c.						
1,059 pounds of Carolina paddy	35	4	10			
69 „ of Sumba paddy	1	6	1			
569 „ of Car paddy	9	7	9			
23½ „ of Burmah Car paddy	0	6	0			
355 „ of Goondoo Sumba paddy	7	1	7			
511 „ of Pegu paddy	8	8	3			
60 „ of White Pootoo paddy	1	0	0			
172 „ of Tenney seed	7	2	8			
87 „ of Cumboo	4	5	7			
137 „ of Green-gram	5	11	4			
13 „ of Horse-gram	0	5	7			
68 „ of Dholl	5	10	8			
298 „ of Sorghum Saccharatum	14	14	5			
454 „ of Yellow cholum	11	5	7			
38 „ of Indigo seed	3	7	3			
452 „ of Wheat	22	9	7			
414 „ of Corakapilly seed	18	13	1			
114½ „ of Cotton seed	1	14	6			
167 „ of Jute seed	10	0	0			
11 „ of Poppy seed	2	8	0			
17½ „ of Mustard seed	2	0	0			
59 „ of Sunflower seed	3	0	0			
42 „ of Roselle seed	3	8	0			
219 „ of Gingelly seed	22	8	7			
26 „ of Linseed	6	14	5			
145 „ of Castor-oil seed	6	0	8			
356 „ of Raggi	8	14	3			
283 „ of White cholum	8	9	6			
48 „ of Dew gram	2	13	2			
15½ „ of Fenugreek seed	0	15	6			
4 Bunches of plantains	1	0	0			
134½ pounds of Wool	21	0	3			
93 „ of Cotton	22	5	1			
				281	8	2
Cattle Food.						
3,653 pounds of Ground-nut oil cake				49	5	0
Implements.						
Implements and tools as catalogued in Inventory				5,475	2	0
Total				9,822	15	2

Seeds supplied gratis during 1874-75.

Date.	To whom supplied.	Maize.	Cotton.	Carolina Paddy.	Yellow Cholum.	Sorghum Saccharatum.
		lbs.	lbs.	lbs.	lbs.	lbs.
12th May 1874.	R. Ragoonatha Row, Mylapore	10	4	25	10	...
15th „ ...	Doctor Shortt, Shevaroys	...	...	10	...	5
11th June ...	Jaya Row, Madura...	10	20	...	...	...
12th „ ...	C. Rajoo Moodelliar	...	...	10	...	...
„ ...	Najeemodien Saib, Sydapet	5	...	...	...	...
15th „ ...	Ramachendra Row...	10	10	10	...	10
7th July ...	K. Rungasawmy Naidu, Sydapet ...	3	3	...	...	3
„ ...	P. Valayutha Naick, Madras	5	5	5	...	5
16th „ ...	Mr. R. W. Weld, Mayaveram	5	30	15	...	5
17th „ ...	Mr. R. W. Barlow, Chingleput District...	...	...	6	...	1
24th „ ...	Doctor Cornish, Madras	2	...	...	...	3
25th „ ...	Abdoor Kuzzar	5	5	10	...	...
28th „ ...	The Coimbatore Municipality	20	10	...	...	5
31st „ ...	Mr. Mackenzie, Nellore	10	5	...	...	5
3rd Sept. ...	The Badagas, Kaity Valley	5	10	...	5	5
„ ...	Rajoo Chetty, Sydapet	...	...	9¼	...	...
10th „ ...	Moothealoo Chetty, Sydapet	10	10	10	...	5
26th „ ...	Mr. A. D. Lister, Shevaroys	5	...	...	—	2
7th Oct. ...	Captain E. Campbell, Dindigul	10	5	...	...	...
8th „ ...	Bashyam Iyengar, Mylapore	10	10	..	10	5
„ ...	Appavoo Naick, Chingleput	15	...	15	10	...
28th „ ...	Mr. Thomas Stanes, Coonoor	...	...	...	10	10
6th Nov. ...	Ramiah Pillai, Sydapet	5	...	10	...	...
19th „ ...	Bashyam Iyengar, Mylapore	...	...	...	10	...
26th Feb. ...	The Government of Bengal	...	...	150	...	...
	Total ...	145	127	285¼	55	69

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st April 1875

1 Chaff-cutter and universal mill, with bullock power, by Messrs. Ransomes and Sims.

1 Threshing machine, with bullock power, by Emery Brothers.

1 Threshing machine, by Dray Taylor & Co.

1 Threshing machine, with bullock gear and carriage, by Ransomes and Sims.

1 Threshing machine, with bullock gear and carriage by Garret & Co.

1 Winnowing machine, by Garret & Co.

1 Winnowing machine, by Dray, Taylor & Co.

1 Winnowing machine, by Ransomes and Sims.

1 Winnowing machine, by Hornsby and Sons.

1 Winnowing machine, by Smith & Co.

3 Reaping machines, by Samuelson & Co.

1 Drill sowing machine, 8 rows, by Garret & Co.

1 Cylindrical corn screw by Ransomes and Sims.

2 Ploughs by Ames & Co., Boston.

1 Turn-wrest plough and yoke, by Ransomes and Sims.

1 Stone roller.

2 Drill sowing machines, 13 rows, by Garret & Co.

1 Wood drag harrow, by Experimental Farm

2 Iron chain harrows.

4 Bullock hoes.

1 Bullock plough, by School of Arts.

1 Bullock plough, by Mint.

2 Bullock ploughs by Ransomes and Sims.

1 Double mould board plough.

1 Large plough, with two wheels, by Ransomes and Sims.

1 Swing plough, by Roorkee Workshop.

2 Wet land ploughs, by Experimental Farm.

1 Wooden roller.

1 Four-wheel waggon.

1 Stone trolley.

1 Root-pulper, by Ransomes and Sims

2 Sets of iron harrows, with swingletree, by Ransomes and Sims.
3 Country carts.
2 Water carts.
1 Sewage cart, by Gun Carriage Works.
1 Maize sheller, by Ransomes and Sims.
1 Drain-pipe making machine.
1 Barrow drill, by Experimental Farm.
1 Rain guage.
1 Water elevator, by Burges and Key.
1 Water elevator, by Mint.
2 Water elevators, by Experimental Farm.
3 English ladders.
1 Norton's tube well with a rotary motion.
1 English grindstone.
1 Farm bell.
2 Wheel hand-hoes.
14 Cattle yokes.
2 Single bullock carts.
1 Overhead, bullock power, with shafts and gearing.
1 Californian pump.
1 Archmedian pump.
1 Cake-crusher.
1 Two-wheel plough with cultivator, by Ransomes and Sims.
1 Pump, by Roorkee Workshop.
1 Combined mill and oil-cake breaker, by Ransomes and Sims.
1 Chain pump, manual-power.
1 Chain pump, bullock-power.
1 Large platform weighing-machine.
1 Large beam and scales.
1 Cotton gin, by Gordon & Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
1 Country cotton gin.
8 Cottage cotton gins.
2 Cotton gins, by Burges and Key.
1 Hand broad-cast sowing machine.
5 English carts.
1 Malabar spoon bale.
2 Waterproof cart covers.
1 Sack-barrow.
1 Portable scale with weights.
3 Picottah buckets.
4 Leather buckets with ropes and gearing for double mhote.
1 Large wheel-barrow.
13 Wheel-barrows.
3 Hay frames for carts.
1 Hand cart.
1 Sub-soil plough.
3 Clocks.
14 Tables.
14 Chairs.
2 Writing desks.
5 Almirahs.
2 Iron cash chests.
3 Book cases.
1 Dynanometer.
1 Surveying level with stand staves, &c.
Set of bottle levels, chemical apparatus, mortars and pestles, glass beakers, &c.
20 Feeding tubs.
5 Metal feeding troughs.
1 Scythe.
1 Manure drag.
2 Bengal picks.
2 Dutch hoes.
20 Hoes.
3 Hatchets.
2 Hand-barrows.
7 Iron rakes.
35 Mamoties.
1 Large field rake.
13 Crowbars.
16 Picks.
2 Mattocks.
5 Forks of sorts.
1 Horse hoe.
6 Shovels.
4 Bill hooks.
1 Iron real.
10 Grass knives.
4 Manure forks.
14 Digging forks.
4 Sets of bullock harness.
2 Surveying chains with pins.
2 Iron cisterns.
91 Specimen seed bottles.
2 Hedge knives.
3 Pairs of thorn pincers.
1 Ear punch for marking sheep.
1 Mercal, one half-mercal, and one measure.
1 Weeding spud.
3 Pairs of sheep shears.
1 Dibble.
6 Spanners.
5 Mallets.
5 Rammers.
2 Hedge shears.
1 Poultry feeding cage.
1 Maize cob-stand.
2 Driving wheels.
1 Large rubbish screen.
1 Drain scoop.

1 Lactometer.
1 Single barrel fowling piece.
1 Pair of pan scales.
1 Branding iron for marking sheep.
1 Theodolite.
2 Sickles.
1 Chester measure metallic tape, 66 feet.
10 Levelling boards.
1 Screening die, two pipe dies, one hollow brick die, eight brick moulds, one rake for furnace, and one poker.
1 Screw jack.
1 Hoe fork.
1 Leather bucket.
7 Wooden troughs.
1 Hand screen.
1 Cross staff.
3 Iron cots.
3 Country ploughs of different patterns.
3 Benches.
4 Large hand hoes.
1 Small hand hoe.
1 Heavy hatchet.
1 Knife.
4 Reaping knives.
2 Draining spades.
1 Country plough from Napier Foundry.
1 Country reaping knife.
1 Lantern.
1 Pruning knife.
1 Rabbit box.

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1st of April 1875

3 Iron ploughs.
4 Combined ploughs.
1 Set of iron harrows with swingletree.
2 Country carts.
1 Box cart.
6 Reaping hooks.
8 Picottah buckets.
1 Chopper.
20 Feeding tubs.
3 Small wheel-barrows.
6 Digging forks.
7 Yokes.
8 Planters' hoes.
1 Tub for well.
1 Scythe.
1 Weeding spud.
1 Tarpaulin.
1 Measure.
1 Half-mercal.
1 Scale triangle, weights, &c.
2 Spades.
1 Large beam and cattle-weighing scale
9 Fifty-six pound weights.
26 Plough-shares.
1 Table.
1 Hay fork.
1 Mamoty.
1 Pair pincers.
1 Turn-screw.
1 Chisel.
1 Gimlet.
1 Triangle with beater.
1 Water cask.
1 Hand saw.
1 Hatchet.
1 Cold chisel.
2 Mallets.
1 Chaff cutter.
1 Lantern.
1 Steel.
1 Drag harrow.

List of Tools, &c., belonging to the Implement Workshops on the 1st of April 1875.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
18 Tongs.
3 Bellows.
2 Screw plates.
4 Sledge hammers.
6 Small hammers.
6 Chisels "Smith's."
2 Punches.
1 Countersinking punch.
5 Dies or flat chisels.
2 Pairs of calipers.
1 Iron square.
2 Round files.
3 Half-round files.
2 Flat files.
22 Taps for screw plates.
1 Iron brace and 8 bits.
1 Filer's hammer.

1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
1 Square file.
1 Angular file.
1 Bob drill.
2 Screw liners.
1 Bench with 2 vices.
3 Hand saws.
1 Pit saw.
1 Cross-cut saw.
5 Augers.
2 Jack planes.
1 Spoke shove.
1 Spirit level.
1 Shoeing rasp.
1 Pincer.
1 Compass.
8 Carpenters' chisels.
1 Cold chisel and 2 chisels.
2 Set squares.
1 Angle square.
3 Gimlets.
1 Brace with 36 bits.
2 Adzes
1 Hammer.
2 Turn-screws.
1 Plummet.
4 Saw files.
4 Rasps for wood.
1 Mallet.
1 Pair scales.

List of Books added to the Apprentices' Library during 1874-75.

Catalogue of Agricultural Implements.
Indian Journal of Science.
The Principles of Chemistry, by Dr. Julius Adolph Stockhardt, 1852.
Elements of Mechanism, by Thomas Tate, 1859.
The Conchologists' Text Book, by William Maggillinray, Esq., 1853.
Natural Production of Burmah, by Rev. Francis Mason, A.M., 1850.
Elements of Chemical Analysis, Qualitative and Quantitative, by Edward Andrew Parnell, 1845.
The Physiology of Common Life, or the Science of Health, by John Scoffern, M.B, London, 1857.
Elementary Introduction in Chemical Analysis, by Dr. C. Renugins Fresenius, 1853.
A Journey from Madras through the Countries of Mysore, Canara, and Malabar, by Francis Buchanan, M.D., 3 Vols., 1807.
Humboldt's Cosmos, by Alexander Von Humboldt, 4 Vols.
Zoology for Schools, by Robert Patterson, 2 Vols., 1848.
A Manual of the Nellore District, in the Presidency of Madras, by J. A. C. Boswell, M.C.S.
Allen's Catalogue of Agricultural and Horticultural Implements.
A Catalogue—Fat Cattle.
The Journal of the Royal Agricultural Society of England, Vol. X., Part I., 1874.
Do. do. do. do. do. Vol. X., Part II., 1874.
Do. do. do. do. do. Vol. IX., Part II., 1873.
Manual of Physical Research adapted for India, by George Buist, L.L.D., &c., Part I., 1852.
A Manual of Chemistry, Inorganic and Organic, by T. Key, Esq., 1852.
The Culture of Cotton in India, by J. Forbes Royle, M.D., F.R.S., 1851.
Introductory Text Book of Meteorology, by Alexander Buchan, M.A., F.R.S E.
Indian Postal Guide for 1874.
Asylum Press Almanac for 1874.
The Horse, by William Yonatt, 1843.
Treatise on Geology, by Professor John Phillips, F.R.S, 1838.
Our Home Islands, by Rev. Thomas Milner, M.A., F.R.G.S.
Physics, by Professor Balfour Stewart, 1872.
Mensuration for Beginners, by J. Todhunter, M.A., &c., 1871.
Foods, by Edward Smith, M.D., &c.
The Reason Why—Natural History
Asylum Press Almanac for 1875.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY),

FOR THE YEAR ENDING 31ST OF MARCH 1876.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT PRESS, FORT ST. GEORGE.
1877.

CONTENTS.

GENERAL.

TOUR IN THE COIMBATORE DISTRICT;—

	Paras.
Area, Holdings, Population, &c. ...	[1 and 2]
Route, Method of conducting the enquiry, &c. ...	[2 to 4]
General appearance and state of the country ...	[4 to 10]
The Farming of the land irrigated by rivers and tanks, &c. ...	[10 to 16]
The Farming of the land irrigated from wells ...	[16 to 28]
The Farming of the unirrigated land ...	[28 to 46]
Live Stock ...	[46 to 51]
The Ryot ...	[51 and 52]
The Labourer ...	[52 and 53]
OFFICE WORK ...	[54 and 55]
THE USE OF SALT IN AGRICULTURE ...	[55 and 56]
MANURE; AND, GREEN FODDER CROPS ...	[56 to 58]
TOWN REFUSE AND THE PRODUCTION OF FUEL ...	[58 and 59]
FISH CULTURE ...	[59 and 60]

THE SYDAPET EXPERIMENTAL FARM.

SEASON, &c. ...	1 to 3
AGRICULTURAL EDUCATION ...	4 and 5
ESTATE IMPROVEMENTS ...	6 to 8
LIVE STOCK;—	
Dairy Cattle ...	10 to 14
Sheep ...	15
Poultry ...	15
Sprouted grain and pulse, as food for Farm-stock ...	16
Prickly-pear, as food for stock, in times of scarcity ...	16 and 17
SOILS;—	
Salt Land ...	17 to 19
Black Cotton Soils and their physical characteristics ...	19 to 32
MANURES;—	
Brick-kiln ashes ...	32 and 33
Village Night Soil ...	33 and 34
Green Manuring ...	34 and 35
Farm-yard Manure, and, the ashes of cattle dung, as fertilizers ...	35 to 37
CROPS;—	
Germination of seeds ...	37 and 38
Indigo Seed ...	38
The Bamboo, as a paper-making material ...	38 to 41
Prickly Comfrey ...	41 to 43
Plantains ...	43 and 44
Brinjals ...	44 and 45
Rheea ...	45

	Paras.
Ground-nuts	45 and 46
New Orleans Cotton	46 to 48
Live Fences	48 and 49
Chinese Sugarcane	49 and 50
Planter's Friend	50
Maize	50 and 51
Prairie Grass	51
Buffalo Grass	52 and 53
Osage Orange	53
Crop Statistics	53 to 57
IMPLEMENTS, MACHINES, &c.;—	
Chain Pump	58
Double Mhote	58
Single Bullock Carts	59
Sweedish Ploughs	60
Improved Water-cart	60
IMPLEMENT WORKSHOPS	60 and 61
MODEL FARM	61 to 67
ESTABLISHMENT	67 and 68

APPENDIX.

1. Expenditure of the Madras Agricultural Department ... ... 71 and 72
2. Valuation of Live and Dead Stock belonging to the Sydapet Experimental Farm. 72 to 74
3. Seeds distributed gratuitously 74
4. Implements, Machines, Tools, &c., belonging to the Experimental Farm ... ... 74 to 76
5. Do. do. do. Model Farm 76
6. Tools, &c., belonging to the Implement Workshops 77
7. Furniture, &c., belonging to the Office of the Superintendent of Government Farms 77
8. Catalogue of books added to the Library during the year ... ... 77 to 79

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS,

FOR THE

YEAR ENDING 31ST OF MARCH 1876.

GENERAL.

TOURS.

1. In Government Order, No. 1,550, dated the 1st November 1875, I was directed to undertake a tour through the Coimbatore District, in view to collecting information regarding its agriculture.

THE COIMBATORE DISTRICT.

AREA, AGRICULTURAL HOLDINGS, POPULATION, &c.

Large area of ryotwary land paying no revenue.

2. The area of the District is 7,432 square miles, of which 1,298 square miles consists of Government Forests, hill tracts, waste land and, permanently-assessed properties; the remainder, 6,134 square miles, or, 3,925,760 acres is Government land under Ryotwary tenure but, of this, rent is paid only for 2,200,000 acres, leaving 1,725,760 acres of ryotwary land, from which no revenue whatever is derived.

3. The occupied area is held under 215,207 ryotwary leases, as below ;—

Rent.	In 1871-72.	
	Number of Leases.	Total Amount.
Below 10 Rupees ...	142,455	7,07,299
From Rs. 10 to Rs. 30 ...	57,138	9,00,995
" " 30 to " 50 ...	9,602	3,49,068
" " 50 to " 100 ...	4,628	2,97,774
" " 100 to " 250 ...	1,199	1,66,558
" " 250 to " 500 ...	152	48,340
" " 500 to " 1,000 ...	26	18,119
Above 1,000 Rupees ...	7	11,182
Total ...	215,207	24,99,335

From the foregoing, it would appear that, the average rent of a holding is about

Average holding about 12 acres.

Rupees 11½ per annum ; as, the average rent over the whole district is, about 15 annas, per acre, one of these holdings will be about 12 acres in extent. It will be seen that there are a considerable number of good sized holdings, thus ;—

9,602 holdings, each of an area between 30 and 50 acres.
4,628 holdings, each of an area between 50 and 100 acres.
1,199 holdings, each of an area between 100 and 250 acres.
152 holdings, each of an area from 250 to 500 acres.
33 holdings, each above 500 acres in extent.

4. It is true that in some instances a holding may be held in a joint tenancy by two or more persons but, on the other hand, several of the smaller holdings may be held by one person.

5. At the last Census in 1871 the population of the district was 1,763,274, or 237·3 per square mile consisting as follows :—Hindoos 1,715,081 ; Mahomedans 36,026 ; Christians 12,067 ; others 100. Of Europeans and Eurasians there were only 595 in the whole district. Of the entire population, 942,555 persons were classed as Agricultural. Of the 537,000 males entered in the occupation lists, 256,130 were cultivators and 138,679 were laborers; of the latter, three-fourths were employed in connection with land. It will be noticed that there were about 40,000 more persons classed as cultivators than there were ryotwary leases; it is probable that many of these are tenants on the Zemindary and Inam lands and, sub-tenants holding land under other ryots, on the share system. The population of the district in 1851-52 was 1,153,862, but this included about 20,000 persons who inhabited the Neilgherry Hills, deducting these, the population of Coimbatore was in 1851-52 1,133,862; the increase in the population in the last twenty years was thus 629,412 persons, or, 55½ per cent.

Great increase in the population.

ROUTE; METHOD OF CONDUCTING THE ENQUIRY, &c.

6. I began the tour at Pothanore on the morning of Thursday the 13th of January. From Pothanore I passed on to the town of Coimbatore, where I remained for some time. During the halt I was employed in inspecting, the land, in the vicinity watered by wells and by the Noyel River; the Jail Farm; the Municipal Gardens, &c. &c. On the 27th I left Coimbatore for Mettapollium; on my way, I stopped at Goodaloor, from the evening of the 27th to the morning of the 1st of February, and visited several of the neighbouring villages, amongst others, Goundenpollium and Naickenpollium. I reached Mettapollium on the 1st of February and remained there, until the 7th, engaged in inspecting the neighbouring country and the land on the banks of the Bhowany, both to the east and west of Mettapollium; I also, at the same time, inspected the Coffee Estates situated at the foot of the Coonoor Ghaut, and, the cultivated land around Kullar. From Mettapollium I passed on to Annur, which place, I reached on the 8th. During the two days I was at Annur I visited, Vadakaloor, Varapollium and Maitupollium. On the 11th I reached Avenashy, where I camped until the 18th.

While at Avenashy, I inspected the cultivated land in its vicinity and, made several short tours. On the 18th I started for Sattiamangalam Taluq. After seeing the cultivated land in the neighbourhood of Sattiamangalam and visiting several villages situated within a few miles, I left that place, on the 22nd, for the Town of Bhowany. On my way to Bhowany, I camped for short time at Gopichettypollium. I remained at Bhowany until the 2nd of March, and inspected the wet land situated on the banks of the river, as well as, the land watered by the Bhowany channel; and visited several villages to which only "dry" land is attached. On the 2nd of March, I started for Caroor camping at Chavadypollium, Malayampollium and, near the Noyel River, on my way; as, this route followed very closely the Calingaroyen Channel, I had ample opportunities of seeing the cultivation dependant on it. I reached Caroor on the 4th of March, and while there, inspected the land, watered by the Cauvery Channel, and, by the Ambravutty, and, visited Nerur, Andankovil, Punjamathavy and other places. On the 11th of March, I left Caroor for Kongiem, and camped on the way, at Paramathy, and, at Vellakovil; from Kongiem I visited Koundenpollium, Papireddypollium, Siven Malai and some other villages. On the 17th I left Kongiem for Darapuram, and halted at Oothioor. When at Darapuram I visited, Colinjivady, Nilambur, Nunjiampolliem, Alengiam, Condrasanpollium, Punjaputty, Ooppar, Varapollium, &c., and gave much time to an inspection of the land watered by the Ambravutty. On the 28th I started for Oodumulpett, on the way I halted at Thalavoypattanam, at Karathoolavoo, and at Thoongavy. From Oodumulpett, I visited Bodipatti, Chinnaveerumpatti and some other villages. On the 31st I left Oodumulpett for Pollachy; and halted at Gomungalam and at Thippumpatti. When at Pollachy I visited Vadugapollium, Auliar, Palaur, Cotampatti and other villages. I left Pollachy on the 5th of April for Pothanore and stopped at Sunthagoundenpollium, at Kanathoocadoovoo; and, at Othikkalmundapum, at the latter place I inspected a site for the District Experimental Farm. While at Pothanore, I inspected another site which had been selected by the Collector for a District Farm, and I again inspected the land in that neighbourhood watered by the Noyel River; on the 11th of April, I returned to my head-quarters, at Madras.

Made almost an entire circuit of the District.

7. It will be seen that I made almost an entire circuit of the District. I saw something of all the Taluqs excepting Collegal which, I found it impossible to visit, without delaying my tour in the southern and more important parts of the District until, too late in the season. Though, unable to visit Collegal, I met the former Tahsildar of the Taluq who, favored me with much valuable information regarding its agriculture.

Method of conducting the inquiry.

8. The whole of my travelling was performed during daylight, so that, I was enabled to see the country and inspect everything of interest I, usually, camped for a few days in places that appeared suited as centres from which to inspect the neighbouring land, and from these, I made short tours into the surrounding country. The distance apart of these observation centres varied from 15 to 30 miles. I usually visited the ryots at their villages; the inspection of the land belonging to these villages was performed

in company with as many of the ryots as chose to accompany me. During such inspections various topics were discussed bearing on the condition of the country around, the agricultural practice of the locality, &c. In some places, the Ryots came in large numbers to my camp. I did not trust alone, to the information I collected at these gatherings but, availed myself of the frequent opportunities afforded, while passing through the country, of picking up facts from the ryots, whom I found engaged in the fields.

GENERAL APPEARANCE AND STATE OF THE COUNTRY.

Landscape very bare.

9. Around the principal towns the country is usually well wooded and all the chief roads are bordered by trees; but throughout the District, generally, the landscape is exceedingly bare. In some places the rich growth of vegetation on the land irrigated by rivers and wells, forms a redeeming feature in the landscape, however, the amount of land under the influences of irrigation forms but an exceedingly small proportion of the whole area. I was surprised to find the banks of the chief rivers almost without trees. The Bhowany, a few miles above Mettapollium has some fine trees growing near it, but these are confined chiefly to the lower portions of the valley, the higher slopes are generally covered only with low growing bushes, chiefly acacias; further down between Sattiamangalam and the town of Bhowany the banks of the river are almost bare; the banks of the Ambravutty, of the Noyel, and of the Cauvery are equally destitute of trees. Most of the large jungle streams have on their banks narrow fringes of scrub jungle, but it is rare indeed that any good trees are met with in such situations. I saw but little natural forest during my tour, excepting that, growing on the slopes of the Annamalay and the Neilgherry ranges. Of dense jungle, I also saw but little; I passed through several of the so-called jungles, but they are so exceedingly open a horseman could ride through them in almost any direction. These jungles consisted chiefly of acacia bushes scattered apart at wide intervals over the ground; the undergrowth is apparently kept in check by the cattle and goats of the ryots living in the neighbourhood; of pasturage, there is but little in these jungles, the grasses chiefly met with being coarse reedy varieties, useless as fodder except, when quite young. These jungles, would undoubtedly have been cleared long ago had the land possessed any value. A much worse description of jungle and one, which occupies far too extensive an area in this District, is that formed of the prickly-pear. In some places energetic measures appear to have been taken to annihilate this pest but, there are still large areas of land covered by it. Much good agricultural land has been rendered temporarily useless from having been taken possession of by the prickly-pear. Ryots have done much to spread this troublesome pest by using it in so many instances for fencing purposes. In some parts of the district the fields are divided by belts of prickly-pear sometimes of many yards in width. It has been denied that the ryots ever plant the prickly-pear for fencing purposes, but I saw during my tour many newly formed fences, and others, in all stages of growth.

Large areas of land covered by prickly-pear.

Again and again I pointed out to the ryots the serious mistake they were making in allowing so much useful land to remain covered by this pernicious plant, but they seemed not to recognize the evil that arose therefrom though, when advised to plant trees for the supply of fuel for their own use, they invariably expressed, how glad they would be to do so, could they but obtain the necessary land, and yet, many of them had land growing prickly-pear that would have sufficed to provide all the fuel they ever could require for their ordinary domestic wants. But the overgrowth of prickly-pear is not confined to agricultural land, but extends to much of the waste land within and bordering many of the villages; growing under such circumstances it cannot but be highly pernicious to health, especially as the ground under prickly-pear is, in such situations, the refuse depôt of the village. In some places, the ryots excused themselves for having large belts of prickly-pear around their fields, on the ground that they would not be permitted to remove these belts as, they formed demarcation lines or boundaries but, I have reason to believe that if, the ryots were really in earnest in a desire to get rid of the prickly-pear that, they would experience no difficulty on the ground advanced. I was sorry to observe in many parts of the District that those entrusted with the management of the roads are blamable to some extent for the extension of the prickly-pear nuisance. On some of the roads for miles on either side at intervals of from 10 to 30 yards, I saw pits which had been dug in excavating road gravel which are now full of luxuriant prickly-pear. Many of these pits being situated so close together the intervening land cannot be tilled and this, in time, becomes covered with prickly-pear by the spreading of the plants growing in the pits. It seems a great pity to have agricultural land disfigured and injured by these gravel pits; to many of these roads, margin drains would be of great service for carrying off water after heavy rain and, there would be no practical difficulty, in most instances, in obtaining the material needed for road repairs by cutting these drains, as the matèrial appears to be met with, generally, very near the surface.

Prickly-pear occupies land that might produce fuel trees.

Old gravel pits often are prickly-pear nurseries.

10. The general absence of plantations of fruit or fuel trees and the almost complete absence of trees in the ordinary villages shows how very unenterprising are the people. Of the occupied area, 2,200,000 acres, there are only 5,000 acres under plantations of this sort. It is true that, the climate of Coimbatore is not particularly favorable to the growth of trees but, there are no difficulties to be encountered that cannot be overcome by the expenditure of a little labor which, it would be in the power of most ryots to afford, seeing that, it would be chiefly demanded of them at the season of the year when they have but little work to do in their fields. Near the towns of Coimbatore, Darapuram, Bhowany, Caroor, and one or two others, there are many trees of very large growth; the mango trees especially at Bhowany and Darapuram were very fine. The production of trees over the District is, I think, essential to the well-being of its agriculture.

Good trees are produced in the District.

11. As a beginning, in Tree Planting, Government might establish a number of Camping Topes, in different parts of the District, such topes should be situated

at about 10 miles apart along the principal roads, and each should be provided with a well. These topes would afford hints to the ryots, in tree planting, and if, placed under the charge of the officers of the village to which the land was attached the expense of maintenance would be trifling; the topes would be remunerative in time, in the fruit rent, from the proceeds obtained for fuel, and, the camping fees. In many parts of the District there are no Public Bungalows and, in other parts, the Public Bungalows have been rented for private occupation. I found tent-life almost unendurable in the months of March and April when, the tents had to be pitched in open ground exposed to the full glare of the sun. In some places I had no choice but to pitch my tents on the road-side, in order to secure such shade as the road-side trees afforded.

12. It is generally asserted by the ryots that during the past 30 years an immense area of land which, was covered with trees and bushes of a jungly growth, has been cleared, partly in view to the extension of arable culture and, partly to afford fuel, for the railways, and, to meet the largely increased domestic demand. I was shown large tracts of country which, the people declared was under jungle only 20 or 30 years ago.

Large areas of land cleared and brought under the plough during the past 18 years.

13. It is certainly the fact that, *upwards of* 700,000 *acres of land which was growing jungle scrub and coarse grass has, during the past* 18 *years only, been brought under the plough*, and this, must have influenced the climate of the District, seeing that the land thus brought into cultivation is perfectly bare during two-thirds of the year. The people were unanimous in stating that the rainfall had been gradually diminishing during the last 20 or 25 years, in some places they appeared to connect this diminution in the rainfall with, the denudation of the country, though this, was the case only in occasional instances. The evidences brought forward of the smaller rainfall during the last few years in comparison with that of the earlier part of the period before mentioned consisted chiefly of facts relating to the flow of certain jungle streams. I was shown streams which now cease flowing invariably before the end of December that, 20 or 30 years ago were said to have flowed regularly up to the end of February. This matter I think, demands the serious attention of all interested in the welfare of the country.

Gradual diminution of rainfall.

The flow of streams good evidence of rainfall.

14. I am aware that it is asserted that the rain registrations made during a great number of years, in this Presidency, show no perceptible diminution in the rainfall but, if this is the case, it must be remembered that, these rain registrations have been made for a long period, only at a very few places; that, until lately the rain gauges used were imperfect, and the observers, untrained; and that, the localities in which these registrations were made were, generally, well wooded, being in most instances the Head-quarters of a District. *Rain Registrations made in a well wooded part of a District are not likely to show the effect produced by the denudation of another portion* 20 *or* 30 *miles distant.* It is well known how greatly the fall of rain is

Rainfall registrations made in a wooded part of the District not applicable to whole area.

influenced by local conditions. At Sydapet, the rainfall differs from that registered at the Madras Observatory, though, the distance between the two places is only five miles.

15. On most occasions when I met an assembly of ryots I directed attention to the great importance of tree planting, in view to, the production of fruit and of fuel, the improvement of the climate and, the protection of live-stock by affording shelter during severe weather, &c. But though, the people generally agreed with me in the views I expressed, they evinced but little desire to carry them into effect. In one place, after addressing a large assembly of ryots under the shade of a tree, I was informed by a ryot and, the rest appeared to agree with him, that trees would not grow in that locality, I immediately asked what had caused the tree to grow under which we were then standing, and they replied that, "it had come by itself;" as, the tree was bearing seed, at the time, I advised them to collect the seed and to plant it with due care, under the necessary conditions to ensure germination but, they protested that, it would be quite useless to sow the seed for, "the tree only came by itself."

Great ignorance regarding tree culture.

16. I am convinced that if proper means were taken, there would be no difficulty whatever, in clothing with trees, the greater part of the District where trees are needed but, to produce this result, the ryots living in these places must be distinctly informed that, they must plant and rear a certain number of trees for each acre of land under occupation, or, that, the State will plant and rear the trees at the expense of the ryot. If, the State is bound to support the ryot during famine seasons, it certainly has a right to expect that he will take such precautions as are in his power to make these famine seasons as less frequent as possible. On two or three occasions when discussing this question at ryot gatherings, the people said that, if Government ordered them to plant and rear trees that they would do so. It would, I think, be doing a kindness to the people to compel them to plant a certain number of trees on all their holdings, where trees are needed, the trees, of course, to be the property of the people who plant and rear them but, restrictions to be laid down as to felling, &c. The trees need not interfere to any extent with the area of land under cultivation. There is all over the District where trees are needed, sufficient waste land to produce the trees required. In speaking of "waste" land I do not use the word waste as it is understood in the Revenue classification but, in its ordinary sense; there is a very considerable area of the so-called cultivatable land which is, to all intents and purposes, waste and which might be cropped with trees.

The State should compel the ryots to grow trees.

Land available for growing trees without interfering with arable land.

17. I have mentioned that the landscape of the District is exceedingly bare but this, conveys but an imperfect impression of the actual appearance of the country. In the unirrigated tracts there are but few spots on which the eye can rest with pleasure. From rising ground in many places no tree can be seen for miles, excepting perhaps, those bordering a chief road. Much of the arable land is lying untilled, temporarily abandoned, and

Country very bare.

this land has a very untidy appearance from the bushes and tufts of wild vegetation which, spring up on it. In passing through the country I looked in vain for those evidences of enterprise, and industry which are supposed to be characteristic of small farming. Everywhere, were evidences of neglected opportunities. In Ireland, when on a tour of a kind somewhat similar to that I am now referring to, I was frequently shown most satisfactory evidences of what can be done by peasant cultivators, towards the improvement of land; again and again, I saw improvements which could have been effected at a moderate cost, by no other means, and which, were amply repaying the enterprising people who had made them; and, similar experiences are common in most European countries. The ryot, in his management of land, falls far short of the peasant cultivator of most other countries.

No evidence of enterprise and industry.

18. I do not lose sight of the fact that in some places, the ryot has done a good deal more for the land than, merely to perform the acts of cultivation, the wells have, I am aware, been sunk entirely at the expense of the ryot; and, the terraced land under irrigation has, also, been laid out at his cost but, the total area of land in this District, influenced by these improvements, is not 200,000 acres leaving 2,000,000 acres of occupied land altogether untouched by such improvements. It has been said that a peasant cultivator, when holding land on a secure tenure, will convert a wilderness into a garden but, that, such is not always the case, is amply evident from the condition of much of the agricultural land in this District. I have long held the opinion and, my experience in this country has amply verified it that, security of land tenure alone, will not suffice to ensure good farming.

Wells sunk and irrigatable land laid out at the cost of the ryot.

19. The condition of most of the agricultural villages, is very unsatisfactory. In most civilized countries the village is associated with all that is healthful and pleasant but, the majority of the villages I passed through during my tour, are characterized by conditions quite the reverse of these; and this, was specially noticeable after my brief sojourn in the town of Coimbatore, the sanitary state of which has reached such perfection. Not only do most of the villagers live in wretched hovels in which, it is almost impossible that, good health can be secured but, from the untidy and dirty habits of the people, everything around these hovels tends to the production of ill-health. I am aware that many of the inhabitants of these villages have nothing to spend further than suffices for bare existence but, I am also aware that, most of these people have during the long dry season, a great deal of unoccupied time at their disposal which, it might, reasonably, be expected, they would utilize in improving their dwellings, and the state of the surrounding ground. If, it is true, and, I have every reason to believe that it is, that the working members of these village communities lose, on the average, in the year, from four to six weeks' labor earnings, from sickness, produced by the bad sanitary conditions of these villages the people, would have great cause for thankfulness if, some measures could be devised, by the employment of sanitary police or other means, which, would ensure

Bad sanitary state of the villages.

The villagers have plenty of time at their disposal.

better sanitary conditions. I speak thus of the villages from a very unpleasant personal acquaintance with many of them. In passing through the country, especially in the early morning one of the first indications that we were approaching a village was, a sickly odour of decomposing excreta. I consider that the bad sanitary conditions of most of the villages is, *a great agricultural evil.* From the sickness that results, the people do not enjoy that robust health which, is so essential for the proper performance of out-of-door agricultural duties and, frequently they are incapacitated for physical exertions, at the most important agricultural season of the year.

Working classes heavy losers from sickness.

20. I camped near, and, passed through, many villages in which, it was impossible to obtain any water fit for drinking. In many of these villages the chief water-supply for the inhabitants was a tank-well which, derived its water chiefly from the drainage of the surface excreta-saturated-land adjoining, whenever the rainfall was sufficiently heavy. Surely, in regard to the improvement of the water-supply for drinking purposes, something can be effected; if, the people cannot afford to pay the cost of making any needful improvements, they can themselves, at any rate, afford the labor. Each villager had better work for one week in the year, in aiding in the improvement of the sanitary condition of the village, than that each working villager should lose from sickness, at least from four to six weeks' wages in the year, and have his or her constitution undermined.

Villages badly supplied with drinking water.

21. The villages to which irrigated land was attached were in most instances, much superior to those just referred to. Not only were the dwellings larger and more substantial but, they were much more tidy and cleanly; however, these villages are but very few in number, in comparison with the number of villages in the district.

22. As far as could be learnt from observation, the people, generally, in the unirrigated parts of the district appeared to possess but few resources, upon which to fall back in times of scarcity. The stack-yards of villages to which wet land is attached were, generally, well filled; but, in the unirrigated parts of the country, I frequently travelled for miles without seeing a stack of any sort and, it must be remembered that, at the time of my tour, a very considerable proportion of the cereal crops had just been gathered. However, judging from the appearance of the crops that were then standing, it would require the produce of many acres to make a decent-sized stack.

Few resources for dependance in times of scarcity.

23. The general opinion I formed of this district was very different from the opinion I held of it before going on the tour. I had frequently passed on the Railway through the portion of the district between Erode and Mettapollium and, I had also travelled along the line between Erode and Caroor; and, from what I had then seen, it appeared to me that the District was a flourishing one from an agricultural point of view, however, I now know, that the Railway line passes through some of the most favored portions which, are irrigated by the perennial rivers, Bhowany and Noyel. Between Erode and Caroor, the Calin-

Observations made of a country from a Railway carriage misleading.

garoyen Channel accompanies the Railway line almost the entire distance and, near Pothanore the water of the Noyel Channel, on the fertile land in the neighbourhood, produces a most luxuriant vegetable growth. Observations made of a country from a Railway carriage, when travelling at the usual speed, are often most misleading. I was particularly struck in regard to this, from having an opportunity of afterwards examining, in the fields, some of the crops which, I had seen from the Railway train when going to Coimbatore from Madras. Not only do the crops appear much better than they really are but, the area under crop seems much greater than it really is; patches of irrigated land of two or three acres in extent, are seen and noted and, the impression dwells in the mind while, hundreds of acres of untilled waste pass unobserved.

THE FARMING OF THE LAND IRRIGATED BY RIVERS, AND TANKS, &c.

Irrigated land but a small proportion of the district.

24. In the Coimbatore District, irrigated land forms only about 4 per cent. of the land under cultivation but, it pays one-quarter of the entire land revenue of the district. The average rent derived from this irrigated land is about 7½ Rupees per acre, whereas, the average rent of the dry land under cultivation is only about 14½ annas per acre. The total area of land in this district, irrigated by means of rivers and tanks is 106,187 acres, of this 10,490 acres is Inam land, and 7,075 acres is waste; the area of Government land under culture is only 88,622 acres. The following shows the irrigation sources;—

	Area, Acres.
The Cauvery River	4,158
„ Bhowany River	25,679
„ Ambravutty River	21,056
„ Auliar River	4,243
„ Noyel River	14,904
„ Jungle Streams	5,779
„ Rainfed Tanks	12,803
Total ...	88,622

25. I gave much attention to the chief rivers of the District. The Bhowany, I met with first at about ten miles to the west of Mettapollium, and I followed it down to several miles to the east of that town; I again met with it at Sattiamangalam from which place I followed it to the town of Bhowany where, it joins the Cauvery. From Bhowany I followed the Calingaroyen Channel down to the Noyel River about twelve miles to the north-west of the town of Caroor. I saw the Cauvery at Bhowany and again near Nerur. At Caroor I met with the Ambravutty which, I followed for some distance; I again travelled along its banks in the Darapuram Taluq. The Noyel river I saw, near the town of Coimbatore, at Payrur at about six miles to the south of Avenashy, and again, where it joins the Cauvery. The Palaur and Auliar rivers, I met with at the foot of the Annamalay Hills a few miles to the south of the town of Pollachy. At the time of my tour the

Bhowany, and the Cauvery were the only rivers in which there was a moderately good flow of water. The Noyel river was flowing only for a short distance beyond Payrur; lower down, at another place where I saw it, about six miles to the south of Avenashy, the bed of the river was dry in many places while, at its lower end near the Cauvery there was no water whatever. The bed of the Ambravutty near Caroor was dry but, further up near Darapuram and as much further up as I went, there was a small flow of water. The beds of the Palaur and Auliar rivers were nearly dry. The wet cultivation under rivers, in operation at the time of my visit, was therefore confined to the land watered by the river Bhowany and its irrigation channels, some land watered by a channel of the Cauvery near Nerur, a few blocks of land in the neighbourhood of Darapuram watered by the Ambravutty, and the land in the neighbourhood of Pothanore and Coimbatore watered by the Noyel river.

26. It has been stated that the river irrigation supply in Coimbatore is, thoroughly utilized as far as this is possible but, the results of my observations lead me to form a different conclusion. Irrigation water is the one great want of the District and, I feel convinced that, no great difficulty would be experienced in increasing considerably the area of land under river irrigation. The drainage of nearly the whole District is towards the east into the Cauvery, which must, after heavy rains, receive immense volumes of water from the Coimbatore District, judging from the great width of the beds of the streams near their junction with the Cauvery, and the recent evidences they show of high floods.

Much of the Coimbatore water flows into the Cauvery.

27. It may be true that the drainage water from Coimbatore produces in Tanjore, as good results as it could have effected in the Coimbatore District but, while Tanjore would not suffer to any serious extent from losing the water, Coimbatore would benefit very largely from retaining it or, the greater portion of it.

28. The area, irrigated by river water, might be very considerably increased with the water now available for irrigation if, the cultivators could be induced or, compelled, to use the water in a less lavish and wasteful way than is now, universally, the practice, where the only trouble connected with the application of the irrigation water is, the raising of a sluice door.

A great deal more might be effected with the water now available.

29. The land under river irrigation is almost exclusively cropped with paddy; raggy is sometimes grown upon it but, this is only occasionally and, when there is any doubt as to their being sufficient water to mature a crop of paddy.

30. The largest quantity of paddy is produced in the Erode and Sattiamungalam Taluqs, under irrigation from the Bhowany river. The next largest producers of paddy are the Caroor, Darapuram and Oodumulpettah Taluqs, in these Taluqs the Ambravutty supplies the irrigation water. During the official year 1874-75 there were 72,000 acres under paddy. There is nothing worth special notice in the cultivation of the irrigated land, it differs in no respect from the practice in other parts of the Presidency.

31. The usual practice when irrigating paddy with water supplied by gravitation is, to apply daily a quantity sufficient to cover the ground to a depth of two inches, half of this, or, one inch in depth, the ryots say, is absorbed by the soil and, the other inch flows off upon the neighbouring land, the owner of which, takes from the distributing channel another inch, in order that his land may be covered to a depth of two inches; he, in his turn, passes off half of the water to his neighbour's land. In this way, the quantity of water actually consumed is, a depth of one inch, daily, over the area under crop, or, for raising and maturing an acre of five months' paddy, a volume of water, *one acre in area and twelve feet deep,* is required. Such a deluge of water would ruin any ordinary land situated on the level but, fortunately for the cultivators of the irrigated land the water is, in most instances, at a much higher altitude than the irrigated land, and this has admitted of the land being laid out in terraces, in this way, the possibility of the irrigation water accumulating on, or in, the land, to an extent to prove injurious is provided against.

Large volumes of water required to mature one acre of paddy.

32. I am convinced that on most of the irrigated land were the soil properly tilled and manured, there would be no difficulty whatever in producing as good crops of paddy as are now grown, with one-third or at the outside, one-half of the quantity of water now usually employed.

33. On terraced land when the soil is not properly tilled, not manured, or manured only with exceedingly small dressings, it undoubtedly pays the ryot to use the irrigation water *very* freely, *provided, it contains silt.* In such cases the water, to some extent, supplies the place of the manure. The terraced paddy land, is not likely to be brought into a swampy state whatever quantity of water is applied. The terraces, are so many filter-beds placed in the form of steps, the highest being, of course, nearest to the irrigation source.

Silt supplies manure to Paddy crop.

34. When the rivers are in flood their waters, I am informed, contain a very large quantity of suspended silty matter and, at the time of my tour, though there had been no rain for two months or more, the water of each of the rivers when placed in a vessel and left undisturbed for a few hours deposited a distinct layer of fine silt. The beds of the rivers, as far as I saw, afforded but little evidence that, much silt is brought down, but, this absence of silt deposits in the river beds may, I think, be due to the rapidity of the current, during the time of floods. A large amount of silt may be deposited on the land, by the irrigation water from these rivers, and yet there may be but little evidence in the river beds that silt is brought down. A rapid current may prevent the deposit of the suspended silt, until the water reaches the field and becomes stationary. An enormous amount of silt is undoubtedly brought down into the low country by the rivers that rise in the Neilgherries, and the other high ranges of hills; the cultivators of land on the slopes of the Neilgherries know to their cost, what a quantity of fine soil is, during heavy rains, washed down the slopes into the neighboring streams.

Irrigation water contains silt.

35. In one or two places where, at the time of my visit, the irrigation water used was almost clear, I found some luxuriant paddy crops, growing on land which had not received any manure for years, excepting, a few cart-loads, per acre, of the green plant of mudder and wild indigo. In these instances the crops may have been feeding on silt previously deposited, brought into activity by the irrigation water. It is of course possible for a water to be clear and yet for it to possess highly fertilizing properties, indeed, a water may contain in solution plant food of the utmost value. As before noticed the principal rivers in Coimbatore rise in the ranges of mountains which border the District and, as these mountains are formed chiefly of primary rocks in which potash-felspar is one of the principal constituents, it is probable that the rain water in passing over and through these rocks, may take up potash and carry it down into the streams below; and, in this way, the irrigation water may contain a considerable quantity of potash, a mineral, which enters largely into the food of all agricultural crops. Again, a clear water may contain a large quantity of carbonic acid gas and this, is the case, especially with the water of jungle streams which rise in and flow through land covered closely with rank growing vegetation. We know that, the Coimbatore rivers obtain their water chiefly from such jungle streams and, we may reasonably take it for granted that, their waters do contain a large percentage of carbonic acid gas. The great solvent properties of carbonic acid gas are well-known; when carried into the soil by the irrigation water, it acts upon and sets free large quantities of previously inert plant food, and in this way contributes to the production of a good crop. Of course, there is a wide difference between the action of an irrigation water containing potash and, that of one containing only carbonic acid; the former, supplies directly the material which aids in the production of the crop, the latter, merely stimulates into activity the plant food previously in the soil, hence a piece of land irrigated by the former water may be maintained in a fertile state for years, while land irrigated by the latter becomes gradually poorer and poorer as each successive crop is removed. But, a water may contain no appreciable quantity of either potash or carbonic acid, and yet, it may produce good effects when used in irrigation. Air is almost as necessary as water for the healthy growth of the roots of most plants: when irrigation water is properly applied that is, when it filters down through the soil, it carries with it a large quantity of atmospheric air, the oxygen of which, acts on the previously inert plant food and brings it into activity, in much the same way as carbonic acid.

Clear water may possess fertilizing properties.

Air necessary for the healthy growth of plants.

36. My own impression is, that the good effect produced by the irrigation waters of this District is primarily due to the silt deposited on the irrigated land, at certain seasons of the year; for, I made frequent inquiries when visiting this land regarding the yield of the crops it now produces, and, the yield of those it produced twenty or, thirty years ago, and, the invariable reply I received was, that the crops now produced yield quite as satisfactorily as those grown on the land twenty or thirty years ago. Now, if the good effect of the irrigation water was due only to the solvent action of carbonic acid, or oxygen, the water might contain, it is

clear that, the soil would have become less productive year by year as the plant food in the soil was used up by the successive crops.

37. I have said that in this District good crops of paddy might be raised by one-third, or at the most one-half of the quantity of water now usually employed provided, *the ryot manured and tilled his soil properly.* If, the irrigation effects are due chiefly to the action of silt, it is clear that, the less water the ryot uses the less silt will his land get; from the ryots' point of view then, with such water, it is desirable to employ as much as can be obtained; but, the question assumes altogether a different aspect when viewed from the stand-point of the State, which, supplies the water, and which, has 90 per cent. of its land altogether without water. In this country where irrigation water is so invaluable, and where in some seasons, from its absence, so much land is unproductive, it is I think, a serious mistake to allow irrigation water to be used so lavishly merely that, *the ryot may thereby be saved the trouble and expense of properly tilling and manuring his irrigated land.* If, the State, in order to provide manure for the land of the ryot is, obliged to supply twice as much water as is absolutely necessary, it is clear that it is providing the manural matters at a most excessive cost.

A serious mistake to allow irrigation water to be used lavishly.

38. To produce an acre of paddy, as I have already shown, a volume of water is required of one acre in extent and, twelve feet deep or about 3,267,000 gallons; estimating that each gallon contains ten grains of suspended silty matter, capable of being deposited on the irrigated land this would represent a dressing of silt, at the rate of about two tons or about six cart-loads per acre, a very liberal manuring for a crop of paddy.

39. The water of the Calingaroyen Channel after a drought of several months' duration was found, by Mr. Charles Benson, M.R.A.C., to contain three grains of silt per gallon. He examined two samples of the water, one from near the head of the channel and the other from the portion of the channel near Erode; the former contained only three grains of silt per gallon while, the latter which was taken at a place about ten miles lower down the channel contained five grains per gallon. This extraordinary result, was afterwards explained, by the fact that the sample, from near the head of the channel was taken one day earlier than the other sample, and that there was in the interval, a fall of rain amounting to ·27 inches. If, such a slight fall of rain as ·27 inches will add two grains of silt per gallon to the water, it will readily be understood that during the monsoon rains, when the paddy crops are being irrigated, a very large quantity of silt must be in suspension in the irrigation water.

40. Of course, if only half the usual quantity of water was used, there would, be a loss in the year, for each acre cropped with paddy of one ton of silt which, would have to be made good from other sources if, the ryot would keep up the fertility of his soil.

41. The ryots who hold river irrigated land are generally in much superior circumstances to those who rent dry land only; their dwellings are much more

substantial and roomy and the people seem to be in comfortable circumstances. I was sorry however to observe that these ryots, who might be expected to be better farmers than their poorer brethren, practised a system of husbandry in no way superior to that followed by the poorest ryot in the district. The very circumstances which have tended to raise these men a little higher in the social scale, than the poorer cultivators of dry land, have tended to produce results antagonistic to improved farming; for in most instances they, instead of cultivating the land themselves, sub-let it under an agreement for one or more years to under-tenants who, rarely possess any capital excepting sometimes what is represented by two or three pairs of wretched undersized plough cattle. In different parts of the District, there is a difference in the terms stipulated for tenancy; in some places the sub-tenant finds the working cattle, does the whole of the labor from seed-sowing until thrashing, supplies the seed, and such manure as is used and, in return, he receives of the produce from one-tenth to one-third of the grain, according to the productiveness of the land, and one-half of the straw; the ryot, of course, pays the Government rent out of his share; when, the ryot finds the plough cattle he takes the whole of the straw and, when he finds the seed, he takes half of the straw. Very frequently the sub-tenant stipulates to give a fixed quantity of clean paddy, for each acre of ground he rents from the ryot. As, in most of these instances the sub-tenant's interest in the land ceases after the removal of the crop, it is not likely that he will do anything by adopting superior culture or, by using manure, to improve the condition of the land.

Wet land farming in no respect better than dry land farming.

Wet land sublet to pauper cultivators.

42. The position of most of these sub-tenants is extremely bad; in a good season they but just manage to comply with the conditions under which they hold the land but, in most seasons they are unable, from the produce of the land, to pay to the ryot, the stipulated quantity of grain, and to repay him along with the interest, the advances of grain received for their daily support during the growth of the crop. The consequence is that, most of these sub-tenants are deeply involved in debt to the ryot, and are practically his serfs. The ryot, in dealing with his sub-tenants, exacts fully the terms agreed upon; if, the crop does not return as much grain as the sub-tenant promised to pay, the ryot takes the whole crop, and the balance remaining stands to the debit of the sub-tenant at a fixed rate of interest, in grain.

Sub-tenant on wet land in bad circumstances.

43. As before noticed, good crops are produced on much of this river-irrigated land but, this is due entirely to the peculiarly favorable conditions met with on such land. I saw land which was said to produce annually in an average season in two crops from 1,200 to 1,300 Madras measures of paddy, without the aid of any manure excepting three or four cart-loads of the green plant of mudder or wild indigo. But, the water expended on an acre of land in producing such crops would, under good management, have sufficed for the requirements of four or five acres of wheat or maize, one acre of which would have yielded as much human food as the acre of paddy.

The water expended on one acre of paddy would suffice for four or five acres of wheat or maize.

44. The right-of-occupation of much of this river-watered land now commands a high price, sometimes as much as from 200 to 250 rupees per acre; while, that of much of the adjoining dry land would not fetch more than 8 or 10 Rupees per acre. I was shown some irrigated land for which twenty years ago the right-of-occupation was considered to be worth only 50 rupees per acre, but which now is valued at 200 rupees per acre; this great increase in value was not due to any improvements having been effected by the lessee or puttah-holder during these twenty years but, to the largely increased money returns now realized from such land. When the ryot has, at much personal labor, or expense, converted dry land into irrigatable land, by altering its surface and laying it out in terraces, he has, of course, a perfect right, when transferring his holding to an incoming tenant, to demand the full value of the improvements effected; but, when the increased value is due to causes over which he has no control, the State should, I think, share in the larger returns. In most instances, the present high value of the right-of-occupation of this land is not due to any improvements effected by the occupying tenant or, by any of his predecessors but, to the great increase in the population, and, the consequent increased local value of agricultural produce. When the right-of-occupation of irrigated land, situated in ordinary agricultural localities, commands rates out of all proportion to what would represent a fair return on the capital originally sunk, in converting the land into irrigatable land, it is clear that the rent paid by such land must be *very moderate.* In many places the annual Government rent for such land is about 9 rupees, per acre, for one crop, and 12, or, 13 rupees per acre, for two crops; if such land will yield in two crops say, 1,000 Madras measures worth 50 rupees, the net return to the ryot is a very handsome one.

High price at which right of occupation of river irrigated land sells.

THE FARMING OF THE LAND IRRIGATED FROM WELLS.

45. In 1871-72 there were in the Coimbatore District 57,437 wells, of which 49,222 were in good repair and, in full use: assuming that there are, now in the District, 50,000 wells each capable of watering 3 acres of land, there will be altogether 150,000 acres irrigated from wells.

46. The wells are met with chiefly in the neighbourhood of the large towns and villages. From the presence of these wells, the outskirts of many of the towns present a very different appearance to what is seen further out in the District.

47. From conversations with Ryots regarding well-sinking, I learnt that, many of them would attempt to sink wells if, there was any certainty of meeting with water at a moderate depth, without the necessity of cutting through hard rock. I was shown several places where Ryots had gone to much expense in attempting to sink wells and had failed. Well-sinking as conducted by the Ryot is attended with great uncertainty and as, the wells cost frequently from 150 to 300 Rupees, it will readily be understood that after half completing a well and expending a sum equal to, say, one-half of its estimated cost, it is a very serious matter to a Ryot, to have to abandon the work.

Many more wells would be sunk if well-sinking was attended with less uncertainty.

48. Of course, the greatest uncertainty attends the sinking of the first well in a locality, and, there are but few cultivators willing to encounter the risk.

49. In tracts of country suited for wells, but which are yet without them, Government might, I think, set the example in well-sinking; if successful, the probability is that the Ryots would follow the example and sink other wells in the locality, and in this way the general revenue of the District would be made more certain. To meet the interest on the capital outlayed in sinking these wells, a water rate might be charged on the land watered from them.

Government should lead in well-sinking where there are yet no wells.

50. I was surprised to find so little known regarding the Land Improvement Act, under which, Ryots could so readily obtain money, on reasonable terms, for use in sinking wells. I informed many of the Ryots the terms under which they could, under this Act, obtain money for well sinking, and they generally expressed their readiness to sink wells if, provided with money in accordance with the terms of the Act. Some, considered that there should be a provision in the Act, under which the outlay should not be chargeable against the Ryot when the further sinking of a well had to be abandoned, from hard rock being met with or, from the water-bearing strata being found to be too far down. They said that it would be a great hardship if, a man borrowed, say 200 Rupees from Government and after expending half of the amount, in an unsuccessful attempt in well-sinking that, he should be called upon to make good the loss. I explained to them that if, in the place where it was proposed to sink a well, a well-auger was first used, to test the depth of the water-bearing strata and, the nature of the rock overlying it, there would be but little risk in sinking the well but, they still contended that, Government should bear the loss when, the sinking of a well had to be abandoned.

Land Improvement Act.

The employment of a well-auger would remove many of the uncertainties attending well-sinking.

51. Of course, there will always be some amount of risk attending the sinking of a well, but if, the Ryot makes the attempt, in the place pointed out to him by an Officer of Government, appointed for the purpose, and, it becomes necessary for any reason to abandon the work before completion, I think that, the Ryot should not bear the loss. It would only be in rare instances, if proper precautions were taken, that, it would be necessary to abandon the work when only partially completed, and, such losses might be recovered by the State, by slightly increasing the interest chargeable on money advanced for well-sinking.

52. There is I think but little probability of there being a large increase in the number of wells in this District as long as the sinking of a well is attended with a risk such as will frequently represent the loss of a sum, equal to a whole year's income of a Ryot; and, a half, or, even, 1 Per Cent. added to the rate of interest chargeable for money advanced by the State, under the Land Improvement Act would be no hinderance whatever, to those desirous of sinking wells.

53. Of course, in parts of the country where there are already many wells, great caution would have to be exercised in increasing their number or, injury may be done to those already existing from their water supply being lessened.

54. There are considerable tracts of country yet without wells, in all parts of the District, in which wells might be sunk, and where subterranean water is as likely to be met with quite as near to the surface, and in as large quantities as in other parts of the country where there are wells.

Superstitious custom in selecting site for a well.

55. Superstition guides the Coimbatore Cultivator in the choice of a site for a well; generally, he procures a sheep and, drives it to the land in which he desires to sink a well; he then pours some water over the head of the animal and sets it at liberty, it wanders over the ground and, the spot of land over which it shakes its head, to get rid of the moisture, is the place in which the well must be sunk. I could never get from any Ryot any satisfactory explanation of the reason they had in following this ridiculous practice; they admitted when pressed, that the result of sinking wells in sites so selected, was often highly unsatisfactory. The prevalence of this superstitious custom shows what uncertainties attend well-sinking in this District for, the men who follow this practice frequently possess a good deal of common sense in regard to matters which daily occupy their time and attention. They select their site for the well in much the same way as men in other countries decide a course of action on the result of the throw of a coin. However the Coimbatore custom is quite as sensible as the practice adopted in other countries when, the divining-rod is used in the search for water.

56. It is highly unsatisfactory, that an improvement such as the sinking of a well, should be attended with such uncertainties when, it is in the power of the State, at a very trifling expense, to do away with many of these uncertainties.

Trial borings to be made by Government.

57. The Ryots when told that it was possible to bore down through the ground by means of an auger to the water bearing strata, were much delighted, and, expressed their great desire that each Taluq should be provided with one or two of these augers. I, would strongly advise, that, a couple of augers should be obtained for use in the Coimbatore Taluq in the first instance, they should, I think, be placed in the charge of an intelligent Overseer of the Public Works Department, after a little practice, under different conditions he would be able to select the most suitable places for boring for water, which places might be marked by a stone and, the exact position noted on the village map, with information, showing the nature of the strata passed through and, the depth at which water was found. After such experimental tests had been made, the Ryots might sink the wells at any time, when most convenient, when labor and money are available.

Water-raising arrangement.

58. Throughout the District cattle-power is everywhere employed for raising water from wells. The water is lifted from the well in a skin bucket, to the bucket is attached a rope which, at its other end, is fixed to the yoke of a pair of cattle; a roller or pulley is fixed about 4 or 5 feet higher than the discharging trough and, slightly over the well, over this roller, or pulley, the rope travels as the bucket ascends or descends. The bullock path is a very steep incline. When raising the bucket the cattle walk down the

sloping path until the bucket reaches the full height and discharges its contents when, the cattle are again backed up the slope, and the bucket again sinks into the water, to be again raised by the forward motion of the cattle, and thus the process is again and again repeated. This arrangement is certainly very simple, however the cost of raising the water is very great. From experiments I made during my tour, and from the information I then gathered, I find that, when the water is to be raised about 20 feet, it costs the Ryot 2 Rupees for watering an acre of ground once, with an application of water equal to about 23,000 gallons, which is an average watering and equal to a rainfall of about one inch.

Cost of raising water by ordinary means is very great.

59. As, an ordinary crop of Cumboo, Cholum, or, Raggy, receives during growth on the average, from 10 to 12 waterings it will be seen that, the water costs the Ryot from Rupees 20 to Rupees 24 for each acre, of any one of these crops he produces on land irrigated from a well.

60. The following shows the cost of raising water from a well of average depth, by the water-raising arrangement just noticed ;—

Depth of the water below the surface of the ground ...	20	feet.
Cost of the pair of cattle required	40	rupees.
Cost of earthwork, cistern, and, woodwork	20	„
Cost of skin-bucket and rope	6	„
Duration of skin-bucket and rope	3	months.
Buckets emptied per hour	65	No.
Contents of the bucket at the point of discharge ...	20	gallons.
Time occupied by the cattle in going down the slope	10 to 15	seconds.
Time occupied by the cattle in backing up the slope and making ready for return journey	45	seconds.
Day's work	6	hours.
Daily pay of driver	2	annas.
Daily pay of water-distributer	1½	„
Daily hire of cattle (when hired)	6	„

The cost, per day, will be as below ; —

	RS.	A.	P.
Hire of cattle	0	6	0
Hire of driver	0	2	0
Hire of water-distributer	0	1	6
Interest and, wear and tear, at 10 per cent., per annum, on the capital invested, Rupees 66, charged over 250 working days in the year	0	0	5
Cost of replacing buckets and ropes, once in 3 months, charged over 250 working days in the year	0	1	2
Total ...	0	11	1

It takes on the average 3 days' full work to water 1 acre of land, the cost per acre is thus Rupees 2-1-3. When the Ryot employs his own cattle, which is the usual practice, and, drives them himself which is also usual, the actual outlay, of course, will be less but, the amount saved, will be but a poor return to the Ryot for

his labor and, the labor of his cattle; and, it must be remembered that, as the work is severe, the cattle do not last long and, require to be replaced at, sometimes very short intervals. The expenses cannot therefore be put at less than the sum I have mentioned. The working hours are generally from 7 A.M. to 10 A.M. and from 3 P.M. to 6 P.M. daily, that is, 6 hours in all. Assuming that, the work throughout the working hours is performed in a regular way, and that 65 buckets, each containing 20 gallons, are raised per hour, the total quantity raised during a day will be 7,800 gallons, at a cost of Annas 11 Pie 1 or, about 11,260 gallons for one Rupee. This may be accepted as the average cost incurred for raising water from wells; the wells, are in some places from 30 to 40 feet in depth, but in other places, they are only from 12 to 15 feet deep and, I think that, there are many more wells under 20 feet in depth than there are of a depth greater than 20 feet. There is in different parts of the District a considerable variation in the size of the buckets used; I measured some buckets that could contain only 10 gallons of water and, I measured others that would contain 25 gallons at the least.

Double Mhote.

61. I was glad to see in the Town of Coimbatore, 8 Improved Water-lifts at work, all of the kind known as the "Double Mhote"; they were made from a model supplied by the Sydapet Experimental Farm. I learn that there is every prospect that this Improved Water-lift will be adopted in this District. The experience gained with the lift by the Coimbatore Municipality, has been of the most satisfactory character, the lift raises, when worked by one bullock, as much water as was formerly raised by two of the ordinary Water-lifts, each worked by a pair of bullocks.

62. The following shows the capabilities of one of these Improved Water-lifts; the working data was obtained from the experiments made at Sydapet; but the calculations are based on the rate of wages, cost of materials, working hours, &c., prevalent in the Coimbatore District;—

Depth of the water below the surface of the ground ...	20 feet.
Cost of the bullock rquired	53 rupees.
Cost of timber, bricks, lime and labor	100 „
Cost of the 2 skin buckets and the ropes . .	15 „
Duration of skin buckets and ropes	3 months.
Buckets emptied per hour	90 No.
Contents of each bucket at the point of discharge .	30 gallons.
Day's work	6 hours.
Daily pay of driver	2 annas.
Daily pay of water-distributer	1½ „
Daily hire of bullock (when hired)	4 „

The cost per day will be as below;—

	RS	A.	P.
Hire of bullock	0	4	0
Hire of driver	0	2	0
Hire of water-distributer	0	1	6
Interest and, wear and tear, at 10 per cent., per annum on the capital invested rupees 150, charged over 250 working days in the year	0	1	0

	RS.	A.	P.
Cost of replacing the buckets and ropes, 3 times a year, say rupees 60, charged over 250 working days in the year	0	2	10
Oil, &c.	0	0	6
Total .	0	11	10

The cost per day for working this machine is therefore Annas 11 Pies 10. When working at the ordinary speed 90 buckets are raised per hour, and, as each bucket contains 30 gallons when at the point of delivery, the quantity of water raised per hour is 2,700 gallons or, in a day of 6 working hours, the quantity raised is 16,200 gallons. For an expenditure of one rupee, 21,904 gallons of water can be raised to the height of 20 feet by the Improved Lift against, 11,260 gallons, raised for one rupee, by the old-fashioned Lift.

Great saving in cost of raising water by using the Improved Lift.

63. To irrigate an acre of land with the quantity of water generally used, the cost will be, by means of the old-fashioned Water-lift, Rupees 2-1-3 or, by the Improved Water-lift Rupees 1-1-1.

64. I have mentioned before that a crop of Raggy, Cumboo, or Cholum, when grown with the aid of well water, receives from 10 to 12 waterings; the cost then, of the irrigation water for an area of one of these crops will be, when the unimproved Lift is used, Rupees 22-13-9 or, when the Improved Lift is used, Rupees 11-11-11; thus, showing a saving of about 11 Rupees per acre; and, the saving will be greater in the case of many other of the crops raised with water from wells, from the greater quantity of water required.

65. We have, in this District, as before noticed, 150,000 acres of land irrigated from wells, by means of these unimproved Lifts, if then, it is possible to save 11 Rupees, on each acre of crop raised, by substituting the Improved Lift for that now in use, a total saving might be effected amounting to, at the least, two million of Rupees, per annum, for it must be remembered that, much of the land bears 2 crops in the year.

Enormous saving if Improved Lift generally adopted.

66. We often hear of the poverty of the ryot, and yet, we find that, in the District of Coimbatore alone, on the small area irrigated from wells, a saving in the annual expenses of the ryot could be effected, that in the aggregate, *would be nearly equal in amount to the entire annual rent of the District payable to the State.*

67. Water, manure, more cattle labor, and, more manual labor are imperatively demanded by 90 per cent. of the cultivated area. By adopting the new Water-lift, the ryot will be able to water double the area he was previously able to irrigate; if, he prefers not to extend the irrigated area of his holding, he will have cattle labor, and manual labor set free for collecting and bringing manure to his land, and for the more thorough tillage of his soil, &c., &c.

By adopting the Improved Water-lift, labor, &c., rendered available for other improvement.

68. Not only is it possible to reduce greatly the cost of lifting water from wells, but, the water after being raised, might be made to go a great deal further

than it now does, if, proper means were taken. As, a general rule the soils of the Ryot contain but a very small percentage of organic matter, and, the tendency of his farming is to reduce this small percentage still lower. The action of organic matter (humus) in the soil is well known, it enables the soil to take up moisture from the air and to store up that moisture ready for the use of plants. An application of a quantity of water equal to half an inch of rainfall on a soil containing 5 or 6 per cent of organic matter, will produce better and more continued effects than a quantity of water equal to 1 inch of rainfall will on a soil containing only 2 or 3 per cent of organic matter, other conditions being equal. In other words, if the soil was properly manured and tilled, the quantity of water that now suffices only for 3 acres, would suffice for 6 acres, and the effective work of a well would be doubled. There would be no practical difficulty whatever, in increasing largely the organic matter in the soils; it would only be necessary that the Ryot should use farmyard manure in manuring his soil, instead of burning the dung of his cattle or, that he should plough into the soil one or two green crops. The general use of cattle dung as fuel, is the curse of Indian Agriculture, not only is the soil deprived of so much direct plant food but, the physical conditions of the soil are seriously deteriorated when it is cropped without the aid of organic manure. Mr. Schiffmayer, in his experiments, elsewhere reported, found that, the soils of the Sydapet Experimental Farm had their powers of absorbing and retaining moisture increased 10 per cent. by the addition of 5 per cent. of organic matter.

69. Much more skill is exhibited by the Ryot, in the cultivation of the land irrigated from wells, than in the cultivation of either river irrigated land or, ordinary unirrigated land.

70. The cropping of the land irrigated from wells is very varied. Cholum, cumboo, and raggy occupy the largest area, in some portions of the District, land irrigated from wells is cropped only with these crops; as before noticed the ryot recognizes garden varieties of each of these cereals and, as he always sows these varieties on his land that is irrigated from wells, the crops have acquired a habit of early maturity.

71. As a general rule, the crops standing, at the time of my tour, on land irrigated from wells were good as regards, length of straw and uniformity of growth but, the heads or, ears, were generally very small and badly filled with grain.

Tobacco largely grown.

72. Tobacco, is largely grown in this District and, it is raised almost exclusively on the land dependant on irrigation from wells. The area annually cropped with tobacco is about 20,000 acres. The crop, is grown throughout the District. The climate of Coimbatore is, generally, well suited for the production of Tobacco but, it is ill suited for the curing operations. Hence, tobacco grown there, should either be sent to a more genial climate to undergo the curing processes or, it should be cured in factories erected for the purpose in which, the peculiar atmospherical conditions required, may be secured.

73. The late Government Quinologist, J. Broughton, Esq., examined, chemically, a number of samples of tobacco, which had been produced in different parts of this District. The following are some of the results obtained;—

Where grown.	Per cent. of ash.	Per cent. of Carbonate of Potash in ash.	Per cent. of Nicotine.
Coimbatore	22·856	2·94	3·32
Do.	22·606	5·64	4·95
Do.	19·923	7·92	4·90
Pollachy	24·987	4·39	1·95
Moocasipoodoor	25·73	7·67	2·24
Coorchy	26·39	7·93	1 17
Poondoray Semoor	23·34	2·65	1·29
Aval	23·49	19 97	1·46
Monigumpollium	26·65	2·61	2·95
Madhally	23·45	5·33	2·32
Sattiamungalum (*A*)	17·09	14·74	2·88
Do. (*B*)	21·34	8·87	3·74
Do. (*C*)	25·14	9·14	3·02

It will be observed that the percentage of carbonate of potash, found in the ash of the tobaccos, varied very considerably; and, it is, it must be remembered, upon the presence of this salt, in the Tobacco, in a sufficient quantity that, its proper burning so greatly depends. Mr. Broughton also examined a sample of Havana and of Manila tobacco which, had been produced in the District, the result was as follows;—

Variety.	Per cent. of ash.	Per cent. of Carbonate of Potash in ash.
Havana	22·55	6·18
Manila	23·25	10·25

The tobaccos contained only a very small percentage of nicotine and their flavours were considered by Mr. Broughton to be very good. With reference to these tobaccos, he wrote in his report;—" I consider that these samples show that foreign tobaccos, if grown in suitable localities in South India, can be produced of their foreign quality. The Manila tobacco, if it had been cured with care by a European or instructed Native would, I am convinced, have possessed the high qualities of foreign Manila tobacco." These samples were produced in the Erode Taluq on an ordinary red soil. The best tobaccos are said to be produced in the Taluqs of Coimbatore, Erode and Sattiamungalum. I saw tobacco growing in all the Taluqs I visited and, observed good crops, and indifferent crops growing in all. However, the market value of the tobacco produced in the southern Taluqs, is never so high as that of the tobaccos of the northern Taluqs. If, ever the production and manufacture of tobacco becomes a Government monopoly in this Presidency, the District of Coimbatore would offer great facilities for the production of tobacco on a large scale. There are good tobacco soils in all the Taluqs but, the Taluq of Sattiamungalum would, I think, afford the best soils and the most favourable climate for the curing operations.

Coimbatore offers great facilities for producing tobacco on an extensive scale.

74. It is said that the red soils produce the best qualities of tobacco and, I should certainly prefer these soils as, they are generally more friable and porous and, do not bake and contract during a slight drought to the same extent as do the black soils. The season in which tobacco is sown varies in different parts of the District but, generally, August and September is the sowing season. The seed is usually sown in nursery beds and, the young seedlings are transplanted out into the field when from 6 weeks to 2 months old. There is nothing worth special notice in the tobacco cultivation of this District. Ryots always endeavour to put their tobacco land in a good manural condition, they fully recognize the exhausting nature of the crop and, the demand it makes upon the soil. Tobacco land is usually manured, by folding sheep upon it, and occasionally, by dressings with village ashes. Tobacco land usually bears a crop of raggy in addition to the tobacco during the year. The harvest season for tobacco, varies of course with the sowing seasons but, over the District generally, the tobacco harvest is in the months of February, March and April.

Great want of uniformity in crops.

75. There is perhaps no crop grown by the Ryot which indicates more accurately the condition of the soil and, the character of the cultivation, than does a tobacco crop. It was not unusual in going through the District to observe, almost side by side, crops that would, probably, not yield 400 lbs. of tobacco, per acre, and others, that might fairly be expected to yield from 750 to 1,000 lbs., per acre, on soils apparently of the same class.

76. The Tobacco crop, from the cost of the waterings it receives, is an expensive one; however, the returns are good, under satisfactory conditions. A crop of 750 lbs., which may be taken as an average one, on fairly farmed land, will realize from 60 to 65 rupees, that is, after the leaf has been prepared for the market; and, this, after paying the Ryot for the labor of himself and his cattle and, for such occasional labor as he may employ, helps towards the payment of the rent of the holding.

Cured tobacco always bad.

77. I saw some very well-grown tobacco in different parts of the District but, everywhere, the cured tobacco was inferior. The advantages the District possesses for the production of the tobacco plant, are nearly altogether lost, from the treatment the leaf receives after leaving the field. The curing process is almost exactly the same as that followed all over the Presidency. There is I think, no probability that, a good marketable tobacco will be produced in this District as long as the curing is in the hands of the Ryot. It is quite impossible that the Ryot, with the very limited means at his disposal, can produce a sample of tobacco that can, at all, approach in appearance or condition, the tobacco produced by the skilled agency and elaborate appliances, employed in other countries.

Tobacco curing factories wanted.

78. In many parts of Coimbatore, the curing of the tobacco produced, would give ample employment to a factory and, several of these might I think, be started with advantage. It is obvious that, if the curing operations of the factory, began with the green leaf when newly harvested that, the area of country from which the tobacco could be received, would be much more limited, than if, the factory began operations on half cured tobacco. The green leaf

would not bear distant carriage, it is so liable to heat when full of sap ; on the other hand, the quality of a tobacco depends very largely upon the skill with which it has been treated in the early processes of curing.

79. Nearly all the tobacco, raised in this District, is cured under the verandahs of the Ryots' dwellings, or, inside their dwellings. Sheds are never erected purposely in which to cure tobacco. The first stages of the curing are performed chiefly out-of-doors, the leaves being suspended in various ways while, drying. I saw in some places, rows of castor oil plants, supporting lines over which tobacco leaves were suspended.

80. Much of the tobacco produced is sent to Malabar. It is said that, a quantity of the Coimbatore tobacco is also forwarded to Trichinopoly where, it is used up with the tobacco produced there. Coimbatore tobacco sells for, when cured, from 5 Rupees to 12 Rupees per 100 lbs.

Tobacco cultivation might be largely extended.

81. There can be no doubt but that, tobacco culture could be largely extended in this District; the climate is favourable for the growth of the crop, there are large areas of land suited for the growth of tobacco and, the special food of the tobacco, potash, is available in large quantities in the shape of saltpetre which is produced to a very considerable extent in many places. One serious defect, universal in the tobaccos of Southern India, arises from the deficiency of potash in the soils on which they are grown; this deficiency, could be remedied to a certain extent, by using saltpetre as a manure, this, on decomposition, would afford nitric acid and potash, foods which are so largely consumed by the tobacco plant, when growing under favourable conditions.

Chillies.

82. Chillies occupy about 15,000 acres of land in the year. They are grown principally in the Pollachy, and Erode Taluqs. The produce is consumed chiefly within the District. The crops that I saw were generally good. The return from one acre of land under chillies is very much less than the return from one acre under tobacco but, on the other hand, the expenses attending the raising of a crop of chillies, are much smaller both in the field and, in preparation for the market.

Sugarcane.

83. Sugarcane occupies about 3,000 acres of the area annually under crop and, fully one-third of the area is in the Coimbatore Taluq. The crops of sugarcane that I observed were very good and apparently well cultivated. The cane is usually milled where it is grown and, the juice made into jaggery. The process is rude, and, wasteful. I was shown some crops from which, a yield of about 100 maunds of jaggery, per acre, was expected, worth about one rupee, per maund. Land intended for sugarcane is always well manured if the Ryot can get this without much trouble. Certain land, is regularly cropped every second year with sugarcane; such land is said to have diminished in yield, during the last 30 years, from 120 maunds down to 80 maunds, of jaggery, per acre.

Sugarcane land diminished in produce.

84. Sugarcane is an expensive crop to grow, where the water has to be raised to a considerable height as, it is usually watered every third day and, is on the

ground for about a year; still, the Ryot who grows it, is afforded regular employment for himself, and for his cattle, for which services, he obtains reasonable compensation in the returns realized when the crop is sold.

85. Seeing that, the District offers so many facilities in its climate and soils for the production of sugar, it is to be regretted that such a small area is cropped with the sugarcane. Under a good system of farming, there would be no great difficulty in increasing the area very largely. But, before the Ryot can enter more largely upon the cultivation of sugarcane, he must adopt a more rational system of agriculture. Sugarcane cannot be produced under the "starvation system" which characterizes the Ryots' treatment of land; manure and thorough tillage are required in order to secure fair results.

The produce of sugarcane demands good farming or good fertile soil.

86. The fact that while this District offers many facilities for the production of sugarcane, it produces in the year, only 3,000 acres on its 2,200,000 acres of occupied land, shows, how low is the agricultural practice. In the sugarcane, the Ryot possesses a crop which will, under fair average conditions, bring in a gross return of 80 to 100 rupees, per acre, and yet, he occupies 95 per cent. of his cultivatable land with crops that do not bring in a gross return of 12 rupees, per acre.

87. The area, annually, under wheat is only about 2,500 acres and, nearly the whole is produced in the Coimbatore Taluq. The variety cultivated is *Triticum Spelta*. It is a bearded wheat and, its grain is covered by an adhering husk. The crop is sown during November and December, and is reaped in February and March. Wheat is always irrigated from wells, generally, about four times a month.

Wheat.

88. Coimbatore wheat is highly appreciated for its bread-producing capabilities. The large European population on the Neilgherries is supported almost entirely on wheat obtained from the Coimbatore District. The grain is admirably suited for making rolong with which the bread used by Europeans in this country, is chiefly made. The grain is hard and gritty and, does not make a good flour, hence the common practice of making rolong from it.

Coimbatore wheat in good demand.

89. The wheat plant is very short, and, the ear is small. The yield, of an average crop, is said to be about 400 lbs. per acre; that is, of grain-in-the-husk.

90. There would be no difficulty whatever in increasing largely the production of wheat in this District provided a better agricultural practice prevailed.

Wheat production might be largely increased.

91. There is a considerable demand, in Southern India, for wheat, at remunerative prices and, there are abundant facilities in the Coimbatore District for producing wheat on a large scale. All that is required is a better system of agriculture, in which, the soil will not be starved but maintained in a good fertile state.

92. There is some need for the introduction of fresh seed and, there would, I think, be no difficulty in obtaining from Egypt or, from Southern Europe, a variety suited to the Coimbatore climate.

93. Plantains, saffron, sweet potatoes, coriander seed, onions, &c., occupy the remainder of the land irrigated from wells, but the area under each of these crops is small.

Plantains, saffron, sweet potatoes, coriander, &c.

94. As before noticed, the farming of the land irrigated from wells, is superior to the farming of the District generally. Irrigation water is more carefully used by the Ryot when he has had to raise it to a considerable height, he then appreciates more fully its value, and accordingly uses it with care. During my whole tour I do not remember ever having seen any land that was swamped by well water, in the way that is so common when the water used, is supplied from a tank or a channel by gravitation.

The ryot when he has to raise the water from wells appreciates its value and uses it more carefully.

95. If, the users of irrigation water, supplied by gravitation, could be induced or compelled, to use it with the same economy that is practised in dealing with the water raised from a well, the state of the country would be very different to what it now is.

Ryots should be compelled to use river irrigation water as carefully as they use well water.

96. If a wheat crop, can be raised in the District with a quantity of water equal to about a rainfall of 16 inches, there is surely something very wrong when the Ryot is permitted to use in raising a crop of paddy, a quantity of water equal to a rainfall of 144 inches. There can be no doubt but that, an acre of land will, under wheat, produce as much human nutriment as an acre of land under rice.

97. The water of some wells contains mineral food in solution and, when such water is used, its influence is greater than that of pure water; however, I do not think that, the fertility produced on the land irrigated from wells, is due to any extent to the soluble plant food contained in the water; for, the Ryots generally agreed in stating that, their "garden land" which is the land watered from wells, is not productive unless manured. The active growth of crops on land irrigated from wells is due, I think, to the plant food being prepared and maintained in a form easy of assimilation by the growing plant, and, to the energies of the plant being stimulated by the favorable physical conditions under which it is growing; the carbonic acid, and oxygen brought in the irrigation water, playing an important part in the conversion to an assimilable form, of the raw plant food in the manure applied and, in rendering active, the previously dormant food in the soil itself.

Well water acts on the food in the soil and rarely supplies food.

98. Almost the whole of the manure the Ryot ever uses is expended on the land irrigated from wells. It consists chiefly of village ashes, and weathered sun-dried cattle dung but, the general practice in manuring this description of land, is to fold sheep on it during night, the animals being allowed during the day to graze elsewhere. The efficacy of the practice depending upon the quantity of excreta, solid and liquid, deposited on the land by the sheep during the night. The practice of sheep-folding is a good one but, in the hands of the Ryot it is not sufficiently developed. It is clear that, there can be no increase in the manural constituents of an arable soil, from the deposit on it of the solid, and liquid excreta of sheep, that depended for food entirely on the wild

Sheep-folding for manural purposes.

scanty vegetation produced on the soil during the dry season. Yet, the efficacy of sheep-folding as a means of fertilizing a soil, is universally admitted. However, in all civilized countries, when sheep are folded on land, they are provided on the land itself, with green crops, produced by the aid of manure, and, the sheep receive, in addition, a daily allowance of oil-cake, pulse, or grain, hence the higher fertilizing value of their excrement. As sheep-folding is conducted on land in this District there is but a slight increase in manural matters; the chief good, resulting from the plant food being left in a form easily of assimilation by growing crops.

99. Sometimes, land irrigated from wells is sub-let but, this is far from being the usual practice. When sub-let, the sub-tenant pays the Ryot or Puttah-holder one-fourth to one-third of the grain the land produces, the cultivating tenant retaining the remainder of the grain and the whole of the straw. Under such an arrangement, the cultivating tenant provides at his own expense the cattle, seeds, manure, labor, water-buckets, &c., &c.; the Government rent is paid by the Ryot who, holds the puttah or lease. When the Ryot finds the cattle, he usually gets one-half of the grain and one-half of the straw.

100. I have referred very briefly to the manuring of the land irrigated from wells as, I intend, when referring to the cultivation of the unirrigated land, to discuss the subject of manures more fully.

THE FARMING OF THE UNIRRIGATED LAND.

Large area of land altogether without water.

101. Of the total area of occupied land in this District, upwards of two million acres is altogether unaided by irrigation water.

102. The following statement shows the rain-fall registered in the different Taluqs, during the past four years;—

Official year.	Coimbatore.	Sattiamungalum.	Collegal.	Pollachy.	Erode.	Bhowany.	Pulludum.	Darapuram.	Caroor.	Oodumulpettah.
	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES
1871-72	24·53	28·55	35·01	42·33	22·40	20·82	20·72	18·94	24·99	28·14
1872-73	25·47	28·45	37·69	29·44	20·53	37·40	18·05	20·50	39·97	20·27
1873-74	22·13	21·37	35·82	27·66	21·81	17·33	17·11	15·37	26·60	24·78
1874-75	19·61	25·87	38·48	32·58	26·90	32·03	12·35	13·32	20·40	20·71
Average..	22·93	26·06	36·75	33·02	22·91	26 89	17·06	17·03	27·99	23·47

103. In Collegal and Pollachy the rainfall is fair. As a general rule, over the whole District, the heaviest rainfall is in May, October and November; and, the lightest in December, January, February and March.

104. Dry crops are extremely precarious and, unfortunately it is upon the dry crops chiefly, that the people must depend for food. On the better kinds of soils, fair results are obtained in average seasons: however the area of such soils is but small, compared with the area under occupation.

Great increase in the area of unirrigated land.

105. Since 1857, the area of the unirrigated land has been increased 45 per cent. In the official year 1857-58, the area under occupation, was 1,591,976 acres, of which about 85,000 acres was irrigated land, leaving 1,506,976 acres of land unaided by irrigation. In the official year 1874-75, the total area under occupation was 2,298,726 acres; from this, must be deducted the 85,000 acres of irrigated land, which leaves 2,213,726 acres of unirrigated land; or, there were, in 1874-75, 706,750 acres more of unirrigated land than in 1857-58.

Large area of Ryotwary land not paying rent.

106. I have before mentioned that after deducting the land permanently settled, the land under Government forests, hill tracts, and, "waste," altogether 830,720 acres, there remains attached to Government villages, under the Ryotwary tenure 3,925,760 acres; of this 1,725,760 acres is unoccupied and pays no rent.

107. The large increase in the area of rent-paying land would, of course, be a satisfactory proof of progress, were the land properly farmed; for, there can be no doubt but that, under fair cultivation, the inferior soils, in the dry climate of Coimbatore, would yield much more produce, when tilled, than, if left to produce natural herbage for pasturage.

The unrented land contributes largely to the support of the rented land.

108. In this District, as well as throughout Southern India, the unrented land has contributed, and does contribute, largely to the maintenance of the rent-paying land.

Land revenue maintained by bringing more land under cultivation.

109. The revenue from land has been maintained, by gradually bringing more and more of the unrented land under rent. Though, the gross land revenue of the District has been increasing, the average rent of the unirrigated land has, during the last 20 years, been gradually diminishing, as will be seen from the following statement :—

Official year.	Total area.	Deduct area irrigated.	Net unirrigated area.	Gross rent.	Deduct rent of irrigated land.	Rent of unirrigated land.	Rent of unirrigated land per acre.
	ACRES.	ACRES.	ACRES.	RS.	RS.	RS.	RS. A. P.
1857-58 ..	1,591,976	85,000	1,506,976	25,31,004	5,50,000	19,81,004	1 5 0
1858-59 ..	1,626,115	85,000	1,541,115	25,88,441	5,50,000	20,38,441	1 5 2
1859-60 ..	1,708,426	85,000	1,623,426	26,72,323	5,50,000	21,22,323	1 4 11
1860-61 ..	1,727,980	85,000	1,642,980	26,92,342	5,50,000	21,42,342	1 4 10
1861-62 ..	1,776,971	85,000	1,691,971	27,33,874	5,50,000	21,83,874	1 4 8
1862-63 ..	1,829,542	85,000	1,744,542	27,92,762	5,50,000	22,42,762	1 4 7
1863-64 ..	1,910,024	85,000	1,825,024	26,49,901	5,50,000	20,99,901	1 2 5
1864-65 ..	1,959,536	85,000	1,874,536	24,11,925	5,50,000	18,61,925	0 15 11
1865-66 ..	2,092,501	85,000	2,007,501	25,11,080	5,50,000	19,61,080	0 15 8
1866-67 ..	2,199,089	85,000	2,114,089	25,95,782	5,50,000	20,45,782	0 15 6
1867-68 ..	2,214,111	85,000	2,129,111	26,08,243	5,50,000	20,58,243	0 15 6
1868 69 ..	2,229,311	85,000	2,144,311	26,24,533	5,50,000	20,74,533	0 15 6
1869-70 ..	2,245,729	85,000	2,160,729	26,37,372	5,50,000	20,87,372	0 15 5
1870-71 ..	2,307,358	85,000	2,222,358	26,49,784	5,50,000	20,99,784	0 15 1
1871-72 ..	2,293,926	85,000	2,208,926	26,28,772	5,50,000	20,78,772	0 15 1
1872-73 ..	2,290,482	85,000	2,205,482	26,15,898	5,50,000	20,65,898	0 15 0
1873-74 ..	2,285,509	85,000	2,200,509	26,13,114	5,50,000	20,63,114	0 15 0
1874-75 ..	2,298,726	85,000	2,213,726	26,24,119	5,50,000	20,74,119	0 15 0

110. Not having figures showing the actual area under irrigation in each year, during the period to which the statement refers, I have, in order to determine the area of unirrigated land, deducted in each year, 85,000 acres which is, about the average area annually under irrigation and, to determine the rent of the unirrigated land I have throughout the statement deducted 5½ lakhs of Rupees in each year, the average income from the 85,000 acres of irrigated land. The area under irrigation is, I believe, almost exactly what it was 20 years ago and, the revenue from it, has varied only slightly from the amount I have taken.

Decrease in the average rent of dry land.

111. It will be seen that the average rent of the unirrigated land, has fallen nearly 30 per cent. in the last 18 years. The decrease is not, I think, due to any reduction in the rent, but, to the large addition to the unirrigated area, of inferior land paying a low rent, which necessarily reduces the average rent of the whole.

Appropriation of the rent-paying land reduces the resources of the Ryot.

112. Of course, the pressure of an increasing population, will gradually force under culture, more and more of the unrented land. We have seen that during only 18 years, this increase has amounted to 700,000 acres, and we may expect that this gradual appropriation of the unrented land will go on until, probably, the whole is taken up for cultivation. Now, it is certainly far better that such land should be under tillage in Districts circumstanced like this, *but, the absorption under tillage of the whole of the Ryotwary land, will destroy the resources upon which the Ryot has hitherto depended so greatly.*

Large increase in area of tilled land, of poor soils badly farmed, a cause for serious alarm.

113. Under the inferior agriculture practised, the recent large increase in the area under tillage is, I think, a cause for serious alarm; for, whenever an unpropitious season occurs, the cultivators of this newly added area, which is, nearly always composed of inferior soils, have nothing whatever to rely upon, and they, as well as those connected with them, have to seek other means of support which, in some seasons, they cannot obtain except by Government establishing relief works. The 700,000 acres of land, added, during the past 20 years, to the area under cultivation, will probably be occupied by not less than 60,000 families.

A rude agricultural practice sufficient when good land abundant.

114. As long as only the moderately good soils are tilled, a rude system of husbandry may suffice to meet the wants of the cultivators but, *directly the inferior soils are taken up for culture, it becomes necessary that an improved agricultural practice should be adopted.* The land, that has recently been added to the cultivatable area, is undoubtedly very inferior, and it is being cultivated in precisely the same rude way as the better soils, of which previously the cultivated area chiefly consisted.

115. I saw large tracts of country which, the Ryots declared did not give more than about 5 bushels of grain, per acre, in the year; and, judging from what I saw of the growing crops, I should think that 5 bushels of grain would be as much as many of these soils would produce on an acre, under imperfect tillage and without manure; now, as 5 bushels of grain would not command more than

6 Rupees in the local market, it will be seen that, after deducting rent, cost of seed, and, cattle hire, or, cattle keep, the Ryot must get but a scanty subsistence, in return for the labor he expends on such land, but, this deplorable state of things is only what might be expected.

116. If, it is necessary that these inferior, previously rejected soils, must be cultivated, it is clear then that, a better system of husbandry must be adopted, in order to get out of these soils a fair return; and, I am convinced that, unless the agricultural practice in dealing with them is greatly improved, the State will experience greater and greater difficulties, on the recurrence of each unfavorable season, in supporting the people dependent on the produce of these soils.

Soils of the District.

117. Considerable portions of the District are covered by black soils, and some large areas by red soils, but, the prevailing soil, is grey in color, and is frequently intimately mixed with, and sometimes covered by, fragments of quartz rock, varying from a fine gravel to pieces of several pounds in weight. These grey soils have, apparently, been formed by the disintegration of the schistose rocks, gneiss, mica and hornblende, which cover so considerable a portion of the District. From their origin, these soils are naturally poor, and when met with on high situations where they have been subjected to the washing influences of flowing-water, they have become very poor indeed, from losing their clayey particles. A small area of country situated about 5 miles to the south of the town of Coimbatore, is covered by a calcareous soil resting over a crystalline lime-stone, and, in the neighbourhood of Coimbatore, a conglomerate lime-stone is met with near the surface but, the soils resting on it are generally very thin, and afford but little support to crops during droughts; a serious drawback in this dry climate. The land bordering the lower slopes of the Neilgherry and Annamalay ranges is, in some cases, composed largely of disintegrated rock washed down from the higher slopes, and is fertile. The soils that cover the lower ridges of hills and, the isolated conical-shaped hills which are scattered over the District, are generally very poor and thin and, in most instances almost altogether without vegetation. Considerable tracts of alluvial soil are found in the eastern and southern portions of the District bordering the large rivers but these soils are generally under irrigation.

A large area of naturally poor soil.

The elevation and fertility of soils bear a close relation.

118. As a general rule, away from the slopes of the high mountains, the best soils are found at the lowest elevations; the soils appear to be worse and worse with each increase in elevation; indeed, the soils of the District, might almost be valued according to their elevation; those in the lowest situations being valued highest and, the value decreasing with every 100 feet of elevation.

119. There is little worth special notice in the cultivation of this unirrigated land. The soil is everywhere only shallow-ploughed and, the only plough used is that common to Southern India, which, stirs the soil but, does not turn it

over. In one or two places I saw some very good cultivation, which, had been produced by digging the ground over with crowbars; by means of these crowbars the soil had been stirred to a depth of fully 12 inches. This cultivation is performed only on black soils, and during dry weather. Blocks of soil varying in weight from 10 to 20lbs. are raised and turned over; after a heavy shower of rain these fall to pieces and a fine tilth is produced. As the clods break down, the roots of grasses, especially of the Hurriallee, which are difficult to remove when the soils are under ordinary tillage, are freely exposed and can readily be collected. The effects of this crowbar cultivation are supposed to last over 10 or 12 years. The expense of turning over an acre of ground, in this way, is great; I was informed that, it took generally about 80 men one day to dig over an acre of ground, and that each of the men was paid 2 measures of grain for his work which, would represent a total cost equal to the value of 160 Madras measures of grain, about 10 Rupees. The cultivation is, I think, very perfect and leaves but little to be desired. However, the area of land thus treated, in the year, is exceedingly small; throughout my whole tour I did not see 100 acres in all, undergoing this cultivation and, my tour was in the season in which this species of cultivation is generally performed.

Deep stirring by means of crowbars.

120. A considerable area (about 300,000 acres) of the occupied land is annually under fallow; but, this so-called fallow is widely different from what is known as fallow in other countries for, the land is, in most instances, left untouched by the plough, or other implement, during the whole period it is supposed to be under fallow. Of course, as the land during the period produces no crop, it is resting for a time, but, it gains but little from those influences, from which land benefits so greatly when fallowed in a rational way.

The so-called fallow land in this country is land temporarily abandoned.

121. Nothing whatever is known by the Ryot regarding "rotation of crops" as this is understood in other countries; I say this advisedly, for I have taken some trouble in making enquiries. In some places I was informed that the Ryots did follow a rotation in their cropping but, on making further enquiry I learned that, the so-called rotation, existed only in the imagination of my informants. In one place where I made enquiries I was informed that the so-called rotation was;—cholum followed by cumboo, in each year repeated, again and again, as long as the land would continue to bear a crop. The Ryots, of course, understand that certain crops make a greater demand on a soil than others; for instance, it is common to crop land with sugarcane only every second year; while, land is cultivated with cotton in successive years, over a long period. Again, crops requiring much rain, are grown during the season of the year in which the rain-fall is usually the heaviest, and crops that can be sustained during growth by a moderate rain-fall aided by dew, are grown during that part of the year when the dews are heaviest; and, the same, in regard to temperature, some crops are grown only during the cold season when the temper-

Nothing known of Rotation of crops, as understood in other countries.

ature is low, and others, only in the hot season. A rotation of crops is based on the following ;— (1) each kind of crop takes up some particular kind of plant-food, if any crop is repeated too frequently on a soil the special food on which it feeds, will become exhausted in the soil ; (2) certain insects always prey on a certain description of crop, and when this crop is grown too frequently on the same ground, these insects multiply to such an extent as to become seriously injurious to it; (3) certain crops grow in an upright position and, in the light open shade they afford, give great encouragement to the growth of weeds, while, other crops form a dense shade over the ground and kill down the weeds ; (4) some plants have short fleshy roots and, need, for their healthy growth, that the soil should be open and friable and, in a good manural condition, while other plants have long and numerous fibrous roots, which enable them to live and thrive under conditions, under which a short fleshy-rooted plant would almost starve. There are other reasons besides these given, for the adoption of a rotation in cropping but, neither these, nor those above given, influence the Ryot, in the management of his land.

122. Nothing is more surprising at first, to an agricultural observer, in passing through this District, than the remarkable absence of weeds on the unirrigated land. I travelled over considerable areas of land almost without a weed of any kind ; however, I observed also, *that the untilled waste was almost as free from weeds.* Though I travelled several hundred miles through the District, frequently at a pace not exceeding 2½ miles per hour, I rarely indeed saw any people engaged in weeding the land. Sometimes, in a journey of 15 or 16 miles, I did not pass a single field in which there were any weeding operations going forward. The absence of weeds, on the cultivated land, cannot be attributed to the industry of the people. Annual weeds, appear to be almost unknown, excepting on the land irrigated by rivers or from wells, the long hot dry season effectually disposes of them. In several localities, I saw land which had been lying untilled for some years and which, was nevertheless almost bare and, it must be remembered that, although I ended my tour in the hot season, it was begun, in the cropping season.

Chief cereal crops.

123. The principal crops, on the unirrigated land, are cumboo (penicillaria spicata), cholum (sorghum vulgare), and raggy (eleusine coracana), these together occupy about 70 per cent. of the area of the occupied land.

Cumboo.

124. Cumboo is sown on the red and grey soils during the months of July and August, and is harvested in November and December ; it occupies more of the unirrigated land than any other crop. It is grown most largely in Darapuram Taluq but, all the Taluqs produce a considerable area, excepting Oodumulpett and Collegal. The grain of cumboo constitutes the food of a considerable proportion of the people of the District, and, its straw is consumed by the cattle. Judging from what I saw, the crop is harvested only when *dead ripe*, and its straw, accordingly, will possess a much lower feeding value than it might otherwise possess.

125. Cholum stands next to cumboo as regards the area of land occupied. The white variety is most generally grown. It is sown and harvested in the same months as cumboo. Black or red soils are preferred for cholum. In all the Taluqs a large breadth of ground is cropped with cholum; the largest areas are in the Pollachy and Pulladum Taluqs. The grain of cholum, equally with that of cumboo, is used as human food in the District while, the straw contributes mainly to the support of the draught cattle during 9 months in the year.

Cholum.

126. Next as regards area comes raggy, which occupies annually about 150,000 acres of land. Raggy is also sown during the months of July and August, and harvested between the middle of November and the end of January. Raggy is a very important food grain and is in great demand, not only for local consumption but, for transport to the Hills for the use of coffee plantation coolies. Raggy is cultivated throughout the District, the greatest breadth of land under it being in the Collegal and Coimbatore Taluqs; its straw is also highly valued as cattle fodder.

Raggy.

127. In a small portion of the District where the rains of both monsoons fall, the sowing and harvest seasons are of course different to those I have mentioned. In localities so favourably circumstanced, 2 crops are frequently obtained in the year; a crop of cholum, with the North-east rains, and a crop of cumboo, with the South-west rains.

128. The 3 crops just noticed are grown to some extent on land irrigated from wells. Ryots distinguish 2 varieties of each, they speak of "garden cumboo" and "field cumboo," "garden cholum" and "field cholum," "garden raggy" and "field raggy." There is a very marked difference in the time in reaching maturity between plants of these so-called "garden" varieties, and those, of the "field" varieties; the former, reach maturity on the average in fully 20 per cent. less time than the latter. The garden varieties are generally matured about 15 weeks from the date of sowing, whereas, the field varieties seldom reach maturity within from 18 to 20 weeks from the date of sowing. These differences in growth are due entirely to the differences in cultivation: the so-called "garden" varieties, being always watered during growth have, from long habit, become rapid growers.

Garden varieties of cholum, cumboo, and raggy.

129. The cotton crop stands the next highest, as regards area. The following statement shows the land under cotton during each of the past 22 years;—

Cotton.

—	1853-54.	1854-55.	1855-56.	1856-57.	1857-58.	1858-59.	1859-60.	1860-61.	1861-62.	1862-63.	1863-64.
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
Cotton	113,919	115,527	138,920	91,053	113,663	131,711	120,086	132,233	88,910	132,684	207,646

	1864-65.	1865-66.	1866-67.	1867-68.	1868-69.	1869-70.	1870-71.	1871-72.	1872-73.	1873-74.	1874-75.
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
Cotton	157,856	110,635	115,529	119,247	117,680	121,288	142,118	142,237	178,660	195,307	193,464

130. The annual production of cotton lint in Coimbatore, is estimated to be about 22,000 bales of 400 lbs. each. The consumption of cotton within the District is estimated at 5,000 bales, leaving about 17,000 bales for export. The cotton produced is chiefly sent to Beypore for shipment.

131. Very little cotton is grown in the northern and western portions of the District. The largest area is grown in the Taluqs of Erode and Darapuram.

132. The black and red soils are usually preferred for cotton cultivation, probably because these soils are capable of taking up, and holding, a large quantity of atmospheric moisture which, enables plants growing upon them, to survive the effects of a long drought. Clear dry hot weather, must be secured for the cotton harvest, in order to obtain a good yield of lint, both as regards quality and quantity.

Dry clear weather good for cotton harvest.

The weather experienced in Coimbatore during the months of January, February and March is particularly favourable for the cotton harvest; but, from its extreme dryness, plants growing on soils, approaching in composition sandy soils, die off; hence, in order to secure his cotton harvest, in this dry weather, the Ryot is compelled to sow cotton on moderately retentive soils. Mr. Schiffmayer's experiments, referred to in the accompanying Report of the Sydapet Experimental Farm, shows that, a black cotton soil is capable of holding more than one-third of its entire weight of water;

Black cotton soil great power of absorbing and retaining moisture.

and that, it has, in a very remarkable degree, the power of absorbing moisture from the air; he found in an ordinary cotton soil 9·43 per cent. of moisture and, in one of sandy soils of the Experimental Farm, only $\frac{3}{4}$ per cent. of moisture, after both soils had been equally air-dried; and, he found further, that the air-dried samples, on exposure to the atmosphere during night absorbed, the black soil, $1\frac{3}{4}$ per cent. of moisture, and the sandy soil only $\frac{3}{4}$ per cent.

133. In portions of the District watered partially by the rains of both monsoons, I am inclined to think that the calcareous soils will, under the rude agricultural practice of the District, yield heavier crops of cotton than the soils on which it is usually grown.. The celebrated crop, grown by a former Collector of Coimbatore, Mr. Wroughton, which, on 30 acres of land, yielded 25,000 lbs. of seed cotton, was produced on a calcareous soil resting on a crystalline limestone. Mr. Wroughton, attributed the large crop to the effects of the favorable rains, which the land secured, from its position directly opposite the Palghaut gap, and therefore, securing the benefits of the rains of both monsoons. I had an opportunity of inspecting this land, and would attribute the large crop, to the quantity of lime the soil contains, quite as much as, to the favorable climatical conditions of

Calcareous soils yield well under moderate but regular rain-fall.

the neighbourhood. However, calcareous soils are not met with to any great extent, and such soils if situated in the drier parts, would not be likely to produce good crops of cotton, unless aided by irrigation water. Both the black and red soils would, I am sure, yield very much larger crops of cotton if manured with lime. It is true that, some of the black soil contains nodules of limestone but, the action of lime in this form is exceedingly slow and very limited, in comparison with the action of lime that has been prepared by burning.

134. Cotton is sown generally in the months of September, and October and, the crops are gathered during January, March and April; those I saw were very poor indeed; the people said that, an average crop was from 200 to 250 lbs. of seed-cotton, which gave from 50 to 60 lbs. of clean lint. I certainly saw no crop that seemed likely to produce more than 70 or 80 lbs. of clean lint, per acre, and I saw considerable areas of land, under cotton, from which it seemed to me probable that the yield of clean lint would not be 50 lbs. per acre.

135. Coimbatore cotton is noted for its whiteness; but, its staple is very short. I learn that, there are yet traces in the cotton from some portions of the District, of the Bourbon and New Orleans varieties that were introduced by the Government Cotton Farms upwards of 30 years ago. However, the traces are but slight; which, perhaps is not surprising, seeing how cotton culture is conducted by the Ryots.

Traces of Bourbon cotton in the District introduced by Cotton Farms.

136. Cotton is grown, year after year, on the same land. Cotton land is *never manured*, and, not only is the seed and lint removed, but also, the whole of the plant. The cotton seed is given as payment for cleaning the cotton, or, it is sold; it is rare indeed that it is used for feeding the cattle attached to the land, on which it was raised. Much of the seed is consumed by the cattle employed on the roads, chiefly by those employed in connection with the Neilgherry traffic and, a considerable quantity of the seed is sent to the Neilgherries.

Cotton land never manured and only half tilled.

137. Cotton cultivation appears to be very unpopular. I was frequently informed by Ryots that, they look upon cotton as a *very unprofitable crop*. That this should be so, is not surprising if, as is generally stated, the yield of clean lint throughout this District is on the average less than 50 lbs. per acre, for, *the 50 lbs. would not be worth more, in an average season, than Rupees* 10; and, it must be remembered that, unlike the majority of the crops grown by the Ryot, the cotton crop yields no fodder for cattle while, it is an expensive crop to harvest. I enquired frequently from the Ryots why, if the cotton crop paid so badly, they occupied their good soils with it, to such a large extent, their general reply was, that they grew the cotton, in order that with it they might pay the assessment on their land. I asked why they could not grow grain, which, would give a larger money return on land of the quality required by cotton, in reply they said that, if they grew nothing but grain *they would have nothing wherewith to pay*

Cotton cultivation unpopular.

Government rent as, they and their families could and would consume the whole produce of the land, they, having to content themselves, at present, with only 2 meals of food, per day, instead of 3; *that, as they could not eat cotton, it was therefore available, with which to raise money for paying their rent.* They asserted that most of the Ryots who hold less than 10 acres of dry land, could consume in their own families all the grain their land produced. I asked how men who grew no cotton whatever, managed to live and pay their annual rents, to this they replied that, men, who had no cotton-land, frequently had wells and, with the aid of the well-water they grew tobacco, chillies, &c., and by the sale of which they raised money to pay the rent, and where there were no wells the cultivators bred cattle for sale, from the proceeds of which they obtained money to pay the rent. There is, I think, a good deal of truth in this; however, it should be remembered that under the system of barter practised, the Ryot can, with grain, procure everything he needs, as readily as, if he had the money the grain represented; hence his domestic demand for grain may be much larger than would suffice for the actual food of his household. In the open market, cotton is as easily bartered away; but for the every-day wants of the family, cotton is not nearly so acceptable an exchange as grain.

138. On an ordinary holding of 10 acres of unirrigated land, farmed in the usual way, the crop would not yield more than 1,500 Madras measures of grain in the year which, deducting 10 per cent. for waste, &c., would represent an allowance during a year, of about $3\frac{3}{4}$ measures per day. In the Coimbatore Jail, the food allowed to each male adult consists daily;—

	Ounce.
Cholum	24
Dholl	2
Mutton	5
Vegetable	6
Salt and condiment	5
Total daily ...	42

The total allowance of food is 42 ounces, but it must be remembered that the grain is without husk, adding this, the total daily allowance amounts to fully 46 ounces, which would be about the weight of $1\frac{1}{5}$ measures of cholum or cumboo, which, would not contain so much nutriment as the jail allowance; in a family of 2 adults and 4 children fed on cholum or cumboo, the daily consumption at $1\frac{1}{5}$ measures for an adult male, and $\frac{4}{5}$ of a measure for an adult female, would be for the parents 2 measures, and about $1\frac{1}{5}$ measures for the children, total daily consumption $3\frac{1}{5}$ measures. From this it would appear that the produce of the 10 acres, would be just sufficient to feed the family throughout the year, and leave a trifle for bartering for cloths, &c., if, the members of the family, were as well fed as the convicts usually are; but, in that case there would be nothing available for the payment of rent, &c., hence, the necessity for restricting the diet to 2 meals in the day, and, in this way setting free $\frac{1}{3}$ of the money value of a full diet, for the payment of rent and,

the other charges which, even the humblest Ryot has to meet. It will be seen thus, that there are good grounds for believing the statement made by the Ryots, noticed in the preceding paragraph.

139. Cotton might be produced to any extent in the District of Coimbatore, the climate is admirably suited for cotton culture, and there are large areas of soils, which would produce it heavily under good farming.

Pulse crops.

140. The next important crops are the pulses, Horse-gram (dolichos uniflorus), Mutchehcottay (Lablab vulgaris), Bengal gram (cicer arietinum), Black gram (phaseolus roxburghii), Green gram (phaseolus mungo), Dholl (cajanus indicus). Together these pulses occupy annually about 220,000 acres of land. Horse-gram is the most important, it occupies, about three-fourths of the entire area under pulses. Horse-gram is grown to some extent in all the Taluqs but, chiefly in those of Pulladum and Coimbatore. There is a large demand for this pulse for the Hill markets. Mutchehcottay occupies the next highest area, about 25,000 acres, it is grown chiefly in the Taluq of Darapuram. The area under the other pulses referred to is, in each instance, about 10,000 acres annually.

Horse-gram.

Shamay, Tenney and Varagoo.

141. The cereal crops Shamay (panicum miliare) Tenney (panicum italicum) and Varagoo (panicum miliaceum) are grown to some extent. Together they occupy, in the year, about 150,000 acres. Shamay is grown in all the Taluqs, but chiefly in those of Coimbatore and Pulladum. The cultivation of Tenney is confined almost entirely to the Coimbatore Taluq, and that Taluq also produces the largest area of Varagoo.

Oil producing crops.

142. The area annually under crops that produce seed, yielding oil, is about 80,000 acres. The varieties chiefly grown are Gingelly and Castor, the former, occupies about 55,000 acres and the latter about 25,000.

143. Several other crops are grown on the unirrigated arable land but, from the small area they occupy, they are not of much importance.

Grass land.

144. An exceedingly small proportion of the occupied area is under grass. I saw some fair pasture near Othikkalmundapum in the Coimbatore Taluq, and also, a few patches of middling pasture in the Pollachy and Kongiem Taluqs but, elsewhere in the District, excepting on the slopes of the Annamalays and Neilgherries, on the banks of the larger rivers, and, on the margins of irrigated land, I saw nothing that could be called "grass land." Over the greater part of the country, there is not, in each 1,000 acres of occupied land, more than one acre under pasturage.

Almost entire absence of pasture land.

145. The almost entire absence of pasture land, is a serious defect in the agriculture of this District. The temporarily abandoned arable land, is recognized as "grass land" in the Revenue Classification ; this is, I think, a grave error for, it is calculated seriously to mislead. In all countries, "grass land" is understood to be land which is covered by grass, either throughout the whole year or, during a considerable portion of the year. Now. much of the so-called grass land in the District is altogether without grass.

being almost as bare as the high-way. A country, which has a large area of *grass* land, is in a much safer condition than, a country in which all the land is under arable husbandry.

146. We are told that, " grass land " occupies, at the least, 10 per cent. of the occupied land of this District; such a statement, does no harm when it is understood that, this so-called " grass land " may be land which is altogether destitute of grass but, without this special knowledge, the statement is certainly misleading. I saw a good deal of this so-called " grass land " and, much of it would not, I am sure, yield a barrowful of grass, roots and plants included, per acre. The season had certainly been an unusually dry one, however, this would not account for the poverty of vegetation on the land.

147. In some instances land is specially set apart by the Ryot for the production of grass. I saw some of this land which had been so reserved for periods varying from 10 to 30 years, and, in no instance, did I see anything approaching a sward. In most instances, the grass grew in low tufts which, were scattered over the ground at distances of from 6 to 12 inches, the intervening spaces being quite bare. The grasses, seemed generally to be perennial species; I seldom saw annual grasses or, other annual plants, growing amongst these grasses. I saw one piece of pasture land which, had been under grass for more than 30 years and I am quite certain that if the whole of the produce on the land was *scraped* off, it would not have amounted to 200 lbs. per acre.

148. The Ryot never manures his pasture land and, he crops it incessantly with cattle, sheep and goats as long as these animals can obtain a scanty support on it. The only time when this pasture land is allowed rest, is during and after heavy rain when, the grass, which then springs up, is considered to be noxious to live stock. The grasses are thus never permitted to produce seed or, only to a very limited extent, and hence, much of the ground remains bare.

149. Ryots know nothing whatever about raising grasses from seed. When pasturage is desired, a piece of arable ground is left untilled and, in the course of a few years it becomes covered here and there with scanty tufts of herbage. No attempts are ever made by planting the roots of grasses or, by sowing the seeds of grasses, to improve this scanty pasturage.

150. Not only are the circumstances bad under which land is laid down to grass but, the whole of the subsequent management of the grass, is the very opposite of that under which good results might be achieved. Land when once covered by a scanty pasturage, such as I have described, is abandoned, as far as acts of husbandry are concerned.

151. The consequence of this mismanagement of the grass lands is a serious deterioration in the live stock. It would be impossible that anything else but deterioration, could result to live stock raised on these exhausted grass lands ; if the grass does not in itself afford the food required by the stock during growth and, the special food required is not supplied by other means, the *result must be an*

animal of stunted and imperfect form. Ryots speak with pride of a period 20 or 30 years ago when they possessed fine breeds of cattle and horses, the loss of which, they attribute to the almost total disappearance of grass in the cropping of the District.

152. Ryots complained bitterly about a change in the assessment of land, made some years ago, under which most of their best grass lands were brought under the plough. I have not been able to procure any exact data but, the assertion generally made was, that before the change in question took place, Ryots were permitted to hold grass land at one-fourth of the rent paid for tilled land, without fear of any one taking the land from them. I understand from information, afforded me by the Board of Revenue, in their Proceedings, No. 3,044 of the 2nd December 1876 that, Ryots are still permitted to hold the so-called "grass land" at one-fourth the annual rent payable for their arable land *provided, no person is willing to take up the land for arable culture at the full rent.* The effect of these rules is, to restrict grass to such soils as are not, in the estimation of the Ryot, competent under arable culture to afford even that wretched return, with which he is usually satisfied and, *to induce the breaking up of grass land, whenever its condition is such as to promise a good return under tillage.* Under circumstances such as these, it is not surprising that, good pasturage should be unknown.

153. To produce a good pasture is a difficulty even in England, where the climate is all that could be desired for the growth of grass. In that country, the soil intended to be laid down under pasture is prepared in a most elaborate way: seeds of the varieties of grasses likely to succeed best on the special soils to be sown, are selected, and are sown under conditions calculated to secure good results, the soil being previously put into a good manural condition. In the after-management, the greatest care is exercised.

154. In Great Britain much money is expended on labor and manure, under skilful management, in the laying down of land under grass. There is perhaps no work of the farmer which demands to be more thoroughly performed, than that connected with the laying down of land under grass for pasture. And yet, in this country, with its unpropitious climate, the production of pasturage is supposed to demand nothing from the Ryot but, to result from natural agencies, which, are not one-hundredth part so powerful for good, in the direction required, than are such agencies in England.

155. Such pastures as we have in England could not be produced in Coimbatore, on the unirrigated land, but, moderately good pastures could be produced by the Ryot, if he adopted a better system of husbandry.

156. On the land watered by wells, there would be no difficulty whatever in producing good pasturage; there are many grasses well suited for cultivation under such condition as could be afforded. If the Ryot could be induced, to lay down under grass annually, a portion of his land irrigated from wells, and, to graze this land by his live stock, the soil would be improved for,

the next 2 or 3 succeeding crops, and on the removal of these, the land might again be put under grass. Or, some of the vast volume of water wasted on the paddy crop, might be diverted to land on which grass might be produced. The extraordinary crops of grass produced in the neighbourhood of Madras under occasional irrigation, shows what can be done in this direction.

Unirrigated land diminished in productiveness 30 per cent.

157. Throughout the District, the Ryots agreed in stating that, the unirrigated land has diminished in productiveness fully 30 per cent. during the past 25 years. Many of the men whom I consulted, possessed river-irrigated land as well as unirrigated land and, as these men, without an exception, stated most positively that there was no change whatever in the productiveness of the river-irrigated land during the period in question, we may, I think, accept their testimony as true, especially, as everything tends to support its truthfulness.

158. I took special pains to sift statements made regarding the deterioration in the fertility of the land and, I could come to no other conclusion but that *this deterioration has taken place and to a very alarming extent;* while, it appeared to me equally certain that, the influences which have brought about this result are not only still in operation but, are now operating in a much more intensified form.

Decrease of reserved area and increase of tilled area.

159. I have before pointed out that, the large area of land which, previously to 1855, was untilled, was the reserve which enabled the Ryots to treat their arable land in a somewhat better way, than is now the usual practice; chiefly, by enabling them to keep more stock.

Great diminution in the live stock of the District.

160. Everywhere where I went, the Ryots declared that there has been a great diminution in the live stock of the District. Since returning to Madras, I have carefully examined the statistics of Coimbatore and, I have ascertained that, *in the last* 30 *years, the area under occupation has been increased* 50 *per cent. while, there has been but little change in the number of live stock;* hence, compared with the area of land now under occupation there has been a large decrease. The following statement, shows this;—

Official Year.	Number of Ploughs.	Area of occupied land.	Number of head of Cattle.	Number of heads of Cattle per 100 acres of occupied land.
1838-39 ...	71,381	999,334	657,766	65·82
1839-40 ...	73,193	1,024,702	658,264	64·24
1840-41 ...	74,540	1,043,560	654,254	62·69
1841-42 ...	77,758	1,088,612	644,777	59·23
1842-43 ...	79,485	1,112,790	656,369	58·98
1843-44 ...	80,314	1,124,396	659,935	58·69
1844-45 ...	81,918	1,146,852	661,783	57·70
1845-46 ...	83,916	1,174,824	633,726	53·94
1846-47 ...	84,362	1,181,068	628,799	53·24
1847-48 ...	85,531	1,197,434	633,956	52·94

Official Year.	Number of Ploughs.	Area of occupied land.	Number of head of Cattle.	Number of heads of Cattle per 100 acres of occupied land.
1848-49 ...	86,716	1,214,024	641,735	52·86
1849-50 ...	87,103	1,219,442	655,456	53·75
1850-51 ...	88,055	1,232,770	697,666	56·59
1851-52 ...	88,598	1,240,372	726,192	58·55
1852-53 ...	...	...	...	...
1853-54 ...	...	...	...	...
1854-55 ...	...	...	...	...
1855-56 ...	...	...	...	...
1856-57 ...	*105,339	1,474,746	484,445	32·85
1857-58 ...	...	..	...	...
1858-59 ...	...	...	...	...
1859-60 ...	...	...	...	...
1860-61 ...	...	...	...	...
1861-62 ...	*124,421	1,741,894	628,935	36·11
1862-63 ...	...	...	...	...
1863-64 ...	...	...	...	...
1864-65 ...	...	...	...	...
1865-66 ...	...	...	...	...
1866-67 ...	*147,289	2,062,046	675,340	32·75
1867-68 ...	...	...	...	...
1868-69 ...	...	...	...	...
1869-70 ...	...	...	...	...
1870-71 ...	...	...	...	...
1871-72 ...	*173,011	2,422,154	773,663	31·94

I was unable to procure the area under occupation, in each of the years, for the whole of the period to which the statement refers but, as I possessed statistics giving the number of ploughs, in most of the years in question, I have been able, to some extent, to supply this deficiency. By multiplying the number of ploughs, in each year, by 14, I obtained the area of occupied land. It will be seen from the following that, each plough represents 14 acres of occupied land ;—

Official Year.	Actual area under occupation.	Actual number of Ploughs.	Area under occupation for each Plough.	Average number of acres for each Plough.
	ACRES.		ACRES.	
1861-62 ...	1,776,971	124,421	14·2	14·1
1866-67 ...	2,199,089	147,289	14·9	
1871-72 ...	2,293,926	173,011	13·2	

The number of cattle was determined, by adding in each year, to the actual number of cattle, one-eighth of the number of sheep (8 sheep being estimated as equal to 1 head of cattle). It will be seen that *in the official year* 1838-39 *there were for each* 100 *acres of occupied land,* 66 *head of cattle, whereas, in* 1871-72 *there were only* 32 *for the same area.* It must be remembered that the average live weight of one of the cattle referred to, is not more than 350 lbs. *which, is only the weight of an average sized Cotswold sheep.*

* Now counted only every fifth year.

161. I must again point out that I do not look upon the increased area of arable land as an evil in itself but, it is undoubtedly a great evil under the circumstances I have mentioned. As long as the arable land consisted only of the more fertile portions of the country, and as long as that arable land was, to a great extent, supported by the manure of cattle, fed in the untilled portions of the District, so long were the Ryots able to support themselves by their rude agricultural practice. It is clear, that if the arable land did not receive fair treatment as regards manure, when there were 66 head of cattle for each 100 acres of occupied land, it cannot receive justice now, when for each 100 acres, the number of cattle is only 32. But, not only has the manuring force, as represented by cattle manure, diminished to one-half but, even of that, not more than 50 per cent. is now available as manure, from the great increase in the use of cattle dung as fuel, since the clearing of the jungles. The consumption of cattle dung as fuel is now very large.

Large consumption of cattle dung fuel.

In many native households in Towns, fully one-third of the fuel used is cattle dung. From information I have been favoured with, it would appear that, in Madras, the consumption of cattle dung bratties, amounts to about 100 per mensem, for each adult, in many middle-class native households. In a family consisting of 7 adults and 4 children, 800 bratties are used as fuel in a month, in another family consisting of 3 adults, the monthly consumption is 400 bratties; in another household, consisting of 3 adults and 3 children, the consumption of this fuel is 400 bratties per mensem; in another, consisting of 4 adults and 2 children, the monthly consumption is 400 bratties; in another, consisting of 2 adults and 6 children, the consumption is 450 bratties per mensem; and, in another household consisting of 2 adults, the consumption is 300 bratties monthly. The dung of one average sized bullock would, in a month, collected during the night only, make about 120 bratties. During the dry season an average sized plough bullock, and an average sized cow, yielded at night in a month, a quantity of dung that made, in the first instance, 90 bratties and, in the second, 120; and during some experiments made on the Sydapet Experimental Farm, with the large bullocks used there, it was found that the dung of two bullocks, in 2 months made 734 bratties which was equal to 183 per head, per month. It would therefore appear that in many native households the consumption of cattle dung as fuel, is equal to that obtained from 1 bullock, for each adult forming the household. It is true that, this quantity of dung cannot be used in all households for, the cattle in the country would not nearly suffice to meet such a demand. However, the facts, show to what a large extent cattle dung fuel is used. As fuel is as costly in most parts of Coimbatore as it is in Madras, and as the habits of the people are similar, there cannot be a very great difference in the quantity of cattle dung used; if there is a difference, the probability is, that the consumption of cattle dung is greater in Coimbatore, from it being more accessible to the people.

162. Few people have any idea of the enormous consumption of fuel in our rural districts. I was informed, at one small Town that its population, under 7,000,

used monthly 4,000 bundles of 50 lbs. each of jungle fuel, which is equivalent to upwards of 1,000 tons, per annum or, the produce of at least 100 acres of well grown scrub jungle; besides the jungle fuel referred to, the inhabitants of this Town used a large quantity of cattle dung, the stems of cotton plant, &c. These figures show that the average monthly consumption of jungle fuel per inhabitant of the Town, is 28 lbs.; in the Coimbatore Jail, the monthly consumption of fuel, per prisoner, is 60 lbs.

Large consumption of jungle fuel.

163. As a general rule, Ryots do not readily admit, when asked for the first time, that they do not use manure, it is only after a judicious cross-examination that the fact, that they do not use it, excepting, to a very limited extent, is brought to light: thus :—

Q.—Do you use manure?
A.—Yes.
Q.—What sorts of manure do you use?
A.—Sheep manure and cattle manure.
Q.—Do you use any other kinds of manure?
A.—No; excepting occasionally a small quantity of village sweepings, and, for wet land, Kolinjy and Auvaray leaves.
Q.—How many acres do you hold?
A.—40.
Q.—Is it all arable land?
A.—Yes; all ploughed.
Q.—How many sheep and how many head of cattle have you?
A.—20 sheep and 6 head of cattle.
Q.—Do you use cattle dung as fuel?
A.—Yes.
Q.—What proportion of the cattle dung do you use as fuel?
A.—About half.
Q.—How do you manure your land with the dung of the sheep and cattle?
A.—We generally fold the sheep and cattle on the land in pens at night.
Q.—Are the whole of your sheep and cattle kept in one fold
A.—The sheep are all in one fold and the cattle are generally tethered to the fold on the outer side.
Q.—Do you give your sheep and cattle any special food when folded on the land?
A.—Not the sheep but, the cattle get a little cumboo or cholum straw.
Q.—What size is your fold?
A.—7 yards square.
Q.—The cattle I observe are tied outside of the fold; is this always the case?
A.—Yes, generally.
Q.—Then, the area manured by the cattle tied outside of the fold and by the sheep within the fold must be equal to about 100 square yards, which, will represent the area manured between each time the fold is removed.
A.—Yes.
Q.—How often do you remove your fold?
A.—Every second day.

Q.—Then ; it is evident that you will manure only 100 square yards of land in two days, or, in a month, 1,500 square yards or, in a year less than 4 acres. How do you manure the remainder of your land ?

A.—We cannot manure it, it goes without manure.

Q.—But, you said that you manured your land, whereas, the fact appears that nine-tenths of it is unmanured. How do you explain this ?

A.—I have 8 acres of garden land and this gets the whole of the manure. I never manure dry land. Dry land is never manured, unless, when the cultivator only has dry land, in which case, his dry land gets what manure he has.

Q.—Then, you mean to assert that dry land is never manured except, under the exceptional circumstances you have mentioned ?

A.—Yes. All the manure goes to the garden land, the dry land is cultivated without manure.

The foregoing is compiled from notes taken at conversations held with Ryots and, is representative of many.

164. It was only by putting fact, with fact, that I was able to come to any conclusion, on many of the questions that presented themselves during my investigations. After having ascertained the number and description of stock kept in, or, at a fold, the number of these folds on a holding, the area manured between each removal of the fold and, how long the fold remained in one place, it became a very easy matter to calculate how much land could be manured in the year on the holding.

165. I measured many sheep-folds, the majority of them covered an area of only 50 square yards, and, on the average, they contained 20 sheep and goats of all ages, in addition to the animals inside the fold there were, on the average, 3 head of cattle tethered on the outer side.

Sheep used for manuring purposes.

166. The sheep of the District are used almost entirely for manuring purposes. There were in 1871-72 850,227 head of sheep and goats, dividing these in pens of 20 each, 42,511 would be required, the animals at each pen, inside and outside, would together manure 100 square yards of ground, we must therefore multiply the number of pens by 100 which gives 4,251,100 square yards or 878 acres as the area manured in 2 days, assuming that, on the average, each pen is moved every second day. From these calculations it would appear that, if folding was practised universally throughout the District on the arable land, *only* 158,000 *acres of land could be manured in the year* and that, to do this, the whole of the sheep and goats and, one-fourth of the cattle would be required. Making every allowance for the dung of the remainder of the cattle stock available as manure and, deducting the manure lost at the seasons of the year when folding is unadvisable, or impossible, it is clear that *the Ryot cannot manure in the year more than* 200,000 *acres of land by the dung of sheep and cattle.* Assuming that, the efficacy of the manuring obtained from folding, operates during 2 years, there will be altogether not more than 400,000 acres benefitting from the manure of sheep and cattle, *leaving more than one and three-quarter million acres of the unoccupied land altogether unaided by manure,* thus 75 per cent., at the least, of the occupied land is never influenced

Vast area of occupied land farmed without manure.

by manure. It must not be supposed that the 25 per cent. except the portion irrigated from rivers, is manured in a satisfactory way; the foregoing calculations take no cognizance of the *quality of the manuring*, they show only the area that can be manured under the practice generally followed in folding. I have already directed attention to the imperfections of the folding system.

Nothing known about mineral manures by Ryots.

167. The Ryot of Coimbatore knows nothing whatever of the use of mineral manures. The soils greatly need lime, potash, and, nitric acid yet, these plant foods are never directly applied to the soil by the Ryot, even though, lime and saltpetre are available at prices sufficiently low to justify their use; indeed, so moderate is the price of saltpetre that it is being largely exported for use as a manural agent; if, it pays the British and Continental Farmer to use Indian saltpetre as a manure, surely it would pay the Coimbatore Farmer to use it to some extent, at any rate, in the production of those more valuable crops tobacco, sugarcane, wheat, &c., which, feed so largely upon potash and nitric acid, and which, are now grown to such a very limited extent, not from any fault in the climate but, from the general neglect of manuring. It is true that, the Ryot cannot afford to use these expensive manures in raising crops of the inferior cereals but, in the cultivation of the crops I have mentioned, the can well afford to use them.

LIVE STOCK.

Horses.

168. I did not see a good specimen of either a country-bred horse or pony in the whole District, away from the neighbourhood of large towns. From what I had heard, I was lead to expect that, in the Kongiem Taluq, at any rate, I would see some fair specimens of country-bred horses and ponies but, even in the Kongiem Taluq I did not see a country-bred horse or pony that would, at a Madras auction, sell for 50 Rupees, and I am sure that the majority of those I saw, would have been dear at only half this price. In all my experience I never saw together such a number of undersized wretched-formed brutes as I saw at the Kongiem fair. The average jutka pony of Madras is quite equal to the best of the country-bred ponies of the District that came under my observation. In the Southern Taluqs undersized horses or, large ponies are used for riding, these, generally, are about 13 hands in height and are flat-sided, narrow-chested, long-legged animals; nearly every one had crooked, deformed legs. Yet, I was informed by many Ryots that, at one time, Coimbatore bred some

Coimbatore at one time bred good horses.

really good horses with which the army was supplied; indeed, it is on record in the Proceedings of Government that, even as recent as 30 years ago, the District possessed many really good horses. The Ryots attribute the decline of horse-breeding during the last quarter of a century first, to the absence of good grazing so much of the grass-land having been broken up, and the soil under grass being now so unproductive from insufficient rainfall; and, from the discouragement to local breeding by the army now being supplied almost entirely with horses imported from other countries.

169. Government have, at different times, endeavoured to improve horse-breeding in Coimbatore. In 1831, they sent from Oossoor 4 stallions to travel through the District; and, from that year up to 1847, the District was seldom without any Government stallions. Recently 2 stallions, a horse and a pony were placed at the services of the horse breeders but, the results of the experiment have not been deemed satisfactory. My own impression is that it will be of but little use to place well-bred stallions at the services of horse breeders of this District, until the agricultural practice generally has been very materially improved. There is but little natural pasturage suitable for raising horses, excepting on the slopes of the Annamalays and, Neilgherries, and, the pastures there, are unfitted for grazing horses, from the rough, irregular surface of the ground.

Before horse-breeding can be restored to its former footing better farming must be practised.

170. Horse-breeding can be conducted successfully in this District only when proper crops are raised for the use of horses. The climate of some parts seems suited for horse-breeding, and over a considerable portion, there would be no difficulty whatever in growing lucerne and other green crops, as fodder for horses while, good pasturage could be provided if proper means were taken.

Must provide fodder or grazing for horses.

171. Until a decided change for the better has taken place in the agricultural practice of the Ryot, mule-breeding would, I think, be attended with much more success than horse-breeding. Of course, the mares would need to be maintained in good condition, whether they are used for horse-breeding or for mule-breeding, but, the stallion asses would be maintained at a much less expense than entire horses and, the young mule would thrive under conditions that would prove highly detrimental to young horses. If mules could be produced, at a moderate price, they would be in great demand, not only for use on the Neilgherries, for coffee estates and for the passenger traffic, but also, on the Plains. The mares that I saw in Coimbatore, were certainly not such as would produce good mules but, they would produce better mules than horses. If Government action is necessary, it would, I think, be attended with more success if, brought to bear in the direction of mule-breeding, than of horse-breeding, under the present condition of agriculture in the District.

Mules might be reared in the district.

172. The best cattle are found in the Kongiem, Sattiamangalam and Pollachy Taluqs. The cattle of the northern portion of the District resemble very much the Mysore breed excepting, as regards size. In the southern portion of the District, the cattle more nearly resemble the Kongiem breed. The best cattle are, generally, owned by carters, employed on road traffic, more especially in connection with that of the Neilgherries. It was very seldom indeed that I saw any good cattle on Ryots' holdings. I was much disappointed during my tour in the Kongiem Taluq, with the cattle that came under my notice there, from what I had heard of the Kongiem breed, I had expected to see some good stock, in the Taluq from which the breed had taken its name but, throughout the Taluq, the cattle are now in no respect better than are those of the

Cattle.

neighbouring Taluqs. At the Kongiem fair, I saw congregated together several hundred head of cattle, and amongst these, excluding those belonging to carters, there was not perhaps a dozen animals that in Madras would sell for 40 Rupees per head but, even these, afforded evidence of the qualities of the breed, though now, so greatly degenerated. In the carts on the road between Caroor and Kongiem, I frequently saw some very well-shaped cattle which, were said to possess most of the points of the Kongiem breed. These animals were low-set, square, deep-framed and broad-loined. In color, they were generally red but, I saw some of all the usual cattle colors. For light draught either on the road or in the field, the cattle of this breed appear to be well adapted, and they are active and hardy.

Kongiem breed almost extinct in the breeding districts.

173. It would be a great loss to the agriculture of this country if, the Kongiem breed of cattle should be allowed to become extinct. The Kongiem Ryots who formerly bred cattle said that, they had ceased breeding them from the impossibility now of rearing moderately good animals, except by feeding with grain, and this, they could not afford to do. They informed me that, during the past 10 or 12 years, the breed of cattle for which their Taluq was formerly so famous, has been gradually disappearing. They said that this was due, to the smaller area of grass-land, to the unproductiveness of grass lands during the past few years from the deficient rainfall, and, to so many of the best breeding animals having been sold, the breeders being too poor to keep them. So low has cattle-breeding sunk in this Taluq, from the causes above mentioned that, instead of, as formerly, supplying the neighbouring Taluqs with cattle, Kongiem now obtains most of the cattle required for its own tillage operations, from Sattiamangalam and the adjoining Taluqs. The undersized bullock of Southern India is gradually displacing, even in Kongiem itself, the once famous Kongiem breed; the Ryots find that they can buy these inferior animals at from 8 to 12 Rupees per head whereas, under present conditions, they could not breed and rear a bullock at twice the sum, seeing that, the grazing would need to be supplemented by an allowance of grain. Unfortunately many of the Ryots, seem to consider it better policy to buy a pair of these ordinary undersized plough-cattle, at say 20 Rupees, rather than to expend 20 Rupees, in breeding and rearing a bullock of the Kongiem breed. All they appear to see is that, they can purchase 2 cattle, for the sum that it would cost to breed and rear one; they do not seem to appreciate the saving in cattle-food and in laborer's wages, when 1 pair of cattle does the work of two pairs.

Kongiem now imports cattle from the other taluqs.

The inferior plough bullocks of Southern India displacing the Kongiem breed.

174. In the parts of Kongiem, where cattle are yet bred, they are reared on such grass as they can meet with, aided with an occasional allowance of straw; but, during the 2 or three months before it is intended to offer the animals for sale, they receive daily a small allowance of grain or, in the case of the poorer cultivators, a small daily allowance of the meal of acacia seed. No crops are reared specially for cattle, either in Kongiem or in other parts of Coimbatore.

175. I attended several cattle markets during my tour; in some of these I found bullocks 4 and 5 years old being offered at from 7 to 10 Rupees per head. The fact that a bullock after 4 or 5 years' rearing, will sell at only from 7 to 10 Rupees shows how small is the return from cattle breeding, when managed in the ordinary way by Ryots. I was told by several of the Ryots who had bred cattle that, for a bullock of the ordinary low country breed 5 or 6 years' old, it was rare that they ever obtained more than 15 Rupees per head, and that, at this price they were generally losers.

176. In the hot dry season, the cattle on the land skirting the hill ranges are sent to be grazed on the higher slopes hence, in these localities the cattle are better than those in other parts. The cattle employed on the roads are much better fed than those employed in ordinary agricultural labor; at the various halting places and, in the markets, cholum, both green and dry, was regularly offered for sale, for the use of cart-bullocks. If the Ryot could be induced to maintain his breeding stock in as good condition as the cart-bullocks, there would be but little to complain of.

Cows badly fed.

177. As a general rule, the cows are half-starved; as a consequence, of this mismanagement, but little milk is obtained. During the 2 months after calving, it is usual to remove only about one-half of the milk, the remainder being left for the calf but, afterwards, all is removed, excepting the strippings which the calf is allowed to get. In some places, the practice is to allow the calf to get all the milk during the first 2 months and, half of the milk afterwards.

178. A good cow of the Kongiem breed, will give in the height of the grass season when in full milk, 1½ Madras measures, equal to a little more than 2 quarts daily but, the general average is not more than 1 measure (3 pints) daily, even under favourable circumstances and, the cow, seldom gives milk for longer than 6 months after calving.

No means for checking spread of disease.

179. Throughout the District, during the time of my tour, the cattle were affected by foot-and-mouth disease. In all the markets might be seen standing side by side, healthy and diseased stock. The Ryots appear to attribute but little importance to the foot-and-mouth disease, they said that, they only lost young calves and sickly animals by it but, admitted, that bullocks attacked by the disease, were always brought into a very low weak condition while, the cows lost their milk. However, the Ryots are so accustomed to see their cattle in low condition, that they take but little account of the effect of the disease when, loss of condition is the only result.

Sheep.

180. There are two well defined varieties of sheep in Coimbatore. Throughout the District generally, the sheep are the long-legged, red-colored, hairy animals, of a goat-like appearance, common to many parts of Southern India. In the neighbourhood of Coimbatore, there is a small variety with white wool, and black faces and legs, these in general appearance resemble very much, diminutive South Downs.

181. The reddish colored sheep are said to yield good mutton: when in good condition, an average sized sheep will yield about 25 pounds. When fit for killing, these sheep sell for from 2 to 3 Rupees per head. They are seldom kept in large flocks but, most of the Ryots own a few which, they fold on their land.

182. The white-wool breed is found chiefly in the Coimbatore Taluq. Sheep of this breed, are nearly always owned by persons who depend solely for a livelihood on the income the sheep bring in, when used for manuring land. Generally these sheep are in large flocks. They yield a short white wool which, though of only an indifferent quality, meets with a ready local demand, for manufacture into cumblies and blankets, which are largely used by the tribes inhabiting the Hills bordering the District. The yield of wool is seldom more than 1 lb. per head, hence the flock owners attach but very little importance to it; neither, do they attach any importance to the mutton-producing capabilities of the breed. The sheep are kept as manure producers, and, it is from their employment in this way that their owners derive their income. The flocks are moved about from one holding to another wherever there is a demand for their services; a fixed rate, per night, being paid in grain for each 100 sheep, by the person on whose land the sheep are folded. In some cases, the flock owner is paid as much as 8 measures of grain per 100 sheep per night. The land when folded is generally quite bare: no food is provided for the use of the sheep while folded; during the day time they are allowed to graze in the adjacent country on whatever wild vegetation they may find, on road sides, and, on the marginal divisions of cultivated land. The mutton of this white-wool breed does not appear to be much esteemed in the District. When full grown, the carcass weight of one of these sheep is not more than 20 lbs.

Sheep kept as manure producers.

183. The flocks generally are composed of sheep of all ages and of both sexes. No attempt appears to be made to separate the sexes or, to select the breeding animals.

184. Government have made several efforts to improve the sheep stock of this District. As far back as 1839, 30 half-bred Merino rams were distributed amongst the influential Ryots and cattle-breeders but, the whole of the sheep appear to have died without producing any good result. In 1842, 20 half-bred and 2 pure-bred Merino rams were supplied to the District, and the Collector, Mr. Wroughton, kept them under his own charge instead of distributing them. These rams, he placed with a flock composed of 150 country ewes but, this experiment also appears to have failed. In 1850, 50 half-bred Merino rams were received in the District from the Mysore Sheep Farm; of these, 20 were given to respectable and well-to-do Ryots who, were thought likely to make a good use of the sheep; the remaining 30, were kept under the charge of the Collector. This experiment is also said to have failed; the failure was attributed to the delicate constitution of the sheep and to the want of care in their treatment.

185. The wool produced by the half-bred Merino sheep introduced into Coimbatore, appears to have been very much superior to anything yielded by the indigenous breeds of sheep. The only records available, on these experiments afford

little or nothing by the aid of which an opinion can be formed as to the real causes of the repeated failures, further than, that the sheep were subjected to a great deal of mismanagement.

186. A number of Mysore ewes, which had been exported to the Cape, produced with Merino rams there, a most excellent cross, the wool of which, commanded a very high price. And in Mysore, the Merino rams produced with the indigenous ewes very fair results.

THE RYOT.

Ryots.

187. The Cultivators occupying unirrigated land are generally very poor; the majority of them are deeply in debt. They attribute their poverty to a succession of bad seasons, and to their land having become less and less productive. I pointed out, at several of the Ryot gatherings that, though the produce of the land might now be much less than the produce obtained 20 years ago, the greatly increased value of that produce, far more than compensates the Cultivator for the diminished crops. They admitted, that there had been a great increase in the value of agricultural produce during the period in question, but contended, that this increase in the value of such produce was against the Cultivator rather than in his favor; because, of the largely increased demand for food in his family. On asking for an explanation regarding this statement, the people said that, their families now consisted generally of from 4 to 5 children, whereas, 20 years ago, 3 to 4 children was the average number in a family. They appear to look upon this larger demand for food in their families as a serious drawback to their prosperity for, instead of the higher prices tending to bring in a larger income, they tended only, to increase the cost of rearing a family. They attribute the larger number of their families to the reduced death-rate; many more children now surviving to reach adult years than was formerly the case.

188. They declared that, many of the holdings did not produce as much grain as would, after paying the Government rent, afford the Ryot and the members of his family two meals of food daily, throughout the year. They also asserted that the Cultivators possessed fewer live stock, and those of a much inferior kind, compared with what they formerly possessed; and that therefore their resources in a time of need were less than formerly: the sale of young cattle and sheep, having been the chief resource of Ryots in times when money was urgently required.

189. The usual rate of interest for money borrowed, varies from 18 to 24 per cent. Money is generally advanced to the Ryot on the security of the right-of-occupation of his holding. It is the general practice for the mortgagee after foreclosing a mortgage, to arrest, for any balance of principal and interest remaining unadjusted, after receiving the proceeds of the sale of the right mortgaged; this, I believe, is quite different to the practice followed in England. The right of the mortgagee after foreclosing and receiving the proceeds of the sale, to prosecute further, for any balance still standing in his favor, is a highly pernicious one. A man with a holding, the right of occupancy of which would be worth 500 Rupees, borrows

say 50 Rupees under the usual conditions, for some years he is probably not troubled about the payment of the interest, especially, if he has some well-to-do relatives, it is only when the interest and principal together, amount to about the selling value of the right-of-occupation that, the mortgagee begins to take active steps towards obtaining the settlement of his claim. If his claims are not then settled, he puts up to auction the right-of-occupation to the holding, takes whatever sum is realized, and then, begins a system of persecution in order to obtain the balance. The unfortunate Cultivator who, by this time, has been turned out of his holding, and is compelled to look to field labor as a means of support, is threatened with arrest or, is arrested if he has friends likely to be able to assist him with money. Until the whole claim is paid off the unfortunate debtor may be arrested again and again.

190. The man who mortgages the right-of-occupation of a Ryot's holding is to all intents and purposes a Pawn-broker and, the transaction should be ruled by pawn-broking regulations. Under the arrangement now in force the policy of the mortgagee or pawn-broker, with whom the Ryot deals, is to keep perfectly quiet about the interest, until it with the principal, has amounted to a sum equal to the saleable value of the right pawned or mortgaged, when, the unfortunate debtor is entirely at the mercy of his creditor.

191. It would certainly be a great boon to the Ryot if all his borrowing transactions, were governed by the provisions of an Act somewhat similar to the Pawn-Broking Act of the United Kingdom. At any rate, there should be a limit to the period during which, the recovery of a debt of the sort, under reference, can be made; if the Statute of Limitation does include such transactions, the fact does not appear to be known to the Ryots for, I was informed of several instances in which, for periods of from 5 to 8 years, no interest had been paid and, in which, the mortgagee had enforced his claim for full interest and principal and, in one or two cases, had either arrested or threatened to arrest, for balances due after realizing, by foreclosing the mortgage.

THE LABORER.

Laborers.

192. At the last census there were 138,679 male laborers in Coimbatore, of whom, three-fourths were engaged in employments connected with land. Of these, a considerable number find employment during a portion of the year on the Coffee Estates in the Neilgherry District.

193. During the cultivating season, the agricultural laborer and such members of his family as are able to earn wages, generally meet with employment, but during the other half of the year they experience much difficulty and, have to fall back upon grass-cutting, fuel-collecting and similar casual employment.

Wages payed in kind.

194. It is usual, to pay wages in kind, money wages are only paid in and around the larger towns. When the agricultural laborer is engaged by the year, the usual wage is 40 Madras measures of grain;—cholum, cumboo, or, raggy; when so engaged payment

is only made, when work is actually performed, when sick and unable to work the laborer is not entitled to any allowance of grain. In some localities, the yearly laborer is paid 44 measures of grain per month, with an allowance of three Rupees in the year : in other localities the monthly wage is only 32 measures of grain without any other allowance. A boy, employed by the year, is paid 16 measures of grain per month, with an allowance of 12 annas in money, in the year. Yearly laborers generally receive from the Ryot on hiring, an advance of money varying from Rs. 10 to Rs. 20. The advance is made generally to enable the laborer to pay off the advance, he received from his former employer, whose service he could not leave without first paying off this advance. On entering first upon service, they receive from their employer an advance and this they are seldom able to repay without taking an advance from another person and thus rebinding themselves. It is the policy of the employers to discourage attempts on the part of laborers to repay advances. To all intents and purposes these laborers are serfs ; for, their employers always manage to keep them in their debt. I made frequent enquiries regarding the circumstances of these laborers, the following case may be accepted as a fair illustration ;—Veerasawmy is employed as a yearly cooly, under an agreement, he receives monthly 30 measures of grain ; his wife, when employed for a whole month receives 15 measures of grain ; his family consists of five children none of whom are able to work ; when sick and unable to work his grain wage ceases ; throughout the cropping season his wife works, on the average, 15 days in the month : he loses from sickness about one month in the year ; he pays the rent of his hut, buys cloths with the grain he puts aside when both himself and wife meet with work ; he experiences great difficulty in setting aside any grain for such purposes as, even when both are employed, the quantity received would not suffice to feed themselves and family.

195. The occasional laborer is paid a somewhat higher wage, however, he seldom gets employment out of the cultivating season. Two measures of grain is the usual allowance per day for a man of this class, and one measure per day for a woman. In some localities, the occasional laborer is paid only 1½ measures per day. When the occasional laborer cannot meet with agricultural employment, he goes to the jungles and cuts fuel which, he takes to the larger towns for sale, or seeks for work on the Coffee Estates in the Neilgherry District.

OFFICE-WORK.

196. The following are a few of the subjects on which advice and information was given, during the past year :—

Presidency, Province or District, from which advice or information was asked.	General nature of subject.
Travancore	Asking advice, regarding the treatment of growing paddy severely attacked by insects.
Mysore	Asking advice, regarding the choice of a lift for raising water from a deep well.
Madras	Asking advice, regarding the management of a flock of sheep.
Neilgherries	Asking advice, regarding the selection of a chaff cutter for use where a large quantity of straw chaff is required daily.
Pondicherry	Asking for information, regarding the culture and curing of tobacco.
Ceylon	Asking advice, as to the means to be employed for improving native agriculture.
South Arcot	Asking advice, regarding the laying down of land under permanent grass.
England	Asking for information regarding the habits of the species of bamboo usually grown in Southern India.
Ganjam	Asking opinion regarding two kinds of indigo seed, from which, in the field, very different results were obtained.
Godavery	Asking for detailed information regarding the cultivation of Carolina paddy.
Travancore	Asking advice, regarding the reclamation, for agricultural purposes, of land frequently submerged by the sea.
N.-W. Provinces ...	Asking for information about water-lifts suited for general use in agriculture.
Wynaad	Asking advice regarding the treatment of certain sick cattle.
Madras	Asking opinion regarding the feeding of horses on Guinea-grass.
Malabar	Asking opinion regarding the manural value of the fern, that, grows so abundantly in Wynaad and Coorg.
Mysore	Asking advice about the general construction and size of loose boxes for cattle.
Neilgherries	Asking opinion, regarding the cultivation of Guinea-grass on land situated, at high elevations.
Jubbulpoor	Asking advice regarding the cultivation of tea and coffee.
Wynaad	Asking advice, regarding the cultivation of wheat.
N.-W. Provinces ...	Asking advice, as to the selection of a plough suited for general agricultural use.
Madras	Asking for information regarding the cultivation of coffee.
Calcutta	Asking for advice, as to the means to be taken for improving agriculture in Bengal.
Madras	Asking opinion regarding the feeding value of gram, and, of a mixture composed of gram and maize, in equal proportions.
Malabar	Asking advice, regarding the treatment of land much infested with a grass, with long creeping roots.
Mysore	Asking advice regarding the choice of a set of agricultural implements and machines for an arable farm.
Travancore	Asking for advice regarding the culture and curing of tobacco.
Ganjam	Asking for information about wagons and carts, for carrying bulky loads over bad roads.
Tanjore	Asking for a list of agricultural books, likely to be of use to an intelligent agriculturist.
Neilgherries	Asking for information as to the description of crops likely to suit for general cultivation, on the Neilgherries.
Cuddapah ...	Asking advice as to the choice of a plough for turning over deeply the black cotton soil of the district.
Madras	Asking for information regarding the cultivation of tobacco.

Presidency, Province or District, from which advice or information was asked.	General nature of subject.
Kurnool	Asking for information regarding water-lifts suited for general agricultural use.
Neilgherries	Asking opinion whether cattle dung should be applied to the soil in the fresh state or, after having been decomposed.
Madras	Asking advice regarding the management of poultry.
Neilgherries	Asking opinion regarding the relative value of the manure of lean stock and of that of fattening stock.

197. I had during the past year, a large correspondence with the Board of Revenue; in addition to the letters on the ordinary business of the Department, I addressed the Board, on the following subjects;—

Prickly-pear—as a food for Farm Stock in times of scarcity.—Observations on—Board's Proceedings No. 1,289, dated 14th May 1875.

Madras Agricultural Exhibition.—Revised Prize List and Regulations for—submitted. Board's Proceedings, No. 1,344, dated 18th May 1875.

A Stock-breeding Farm.—Land for—. Report regarding efforts made to secure —and, proposals regarding utilization of Model Farm as—. Board's Proceedings, No. 1,524, dated 5th June 1875, and 2,919, dated 21st October 1875.

Jute Cultivation on the Sydapet Experimental Farm.—Report on—. Board's Proceedings, No. 1,714, dated 21st June 1875.

Carolina Paddy.—Supposed deterioration of—in India. Observations on—Board's Proceedings, No. 1,895, dated 9th July 1875.

Hurriali Grass.—Culture of—. Memorandum on—. Board's Proceedings, No. 1,902, dated 9th July 1875.

Salt-soil.—Analysis of—. Report on—. Board's Proceedings, No. 3,016, dated 1st November 1875.

Maize and other seeds.—Distribution of—. Proposals submitted. Board's Proceedings, No. 189, dated 22nd January 1876.

Agricultural College.—Revised Prospectus for—submitted. Board's Proceedings, No. 942, dated 6th April 1876.

THE USE OF SALT IN AGRICULTURE.

198. The high price of salt in India is, a serious drawback to agriculture. In England, good agricultural salt for the use of stock, or, for use as manure, can generally be purchased at about 30 shillings per ton; similar salt costs, in this Presidency, about Rs. 50 per ton. Live stock cannot be maintained in good health unless, they have frequent and regular access to salt; but, it is rather as a condiment than as a food that, salt is so valuable. It, renders food more palatable, improves the appetite, increases the flow of saliva and, assists the digestive processes. Salt is peculiarly obnoxious to intestinal worms and, the preva-

Indian Farmers must pay three times as much as English Farmers for agricultural salt.

lence of these, and other internal parasites, in such numbers in the farm stock of this country is, to be accounted for, by the almost entire absence of salt in their diet.

As a manure.

199. Salt has long been used for promoting vegetation. It is of the greatest value as a manure in inland countries; land under the influences of sea breezes generally gets, by means of these breezes, sufficient salt for the requirements of agricultural crops; it has been ascertained by direct experiment that, the land near some coasts receives annually as much as 300lbs. of salt, per acre, carried to it by the winds. Salt is generally used as an auxiliary manure with lime or, other manures. In England, as much as 600lbs. of salt, per acre, is applied, with other manure, to land intended for Mangold Wurtzel; and, for meadow land a usual top-dressing is 200lbs. of salt with about 100lbs. of nitrate of soda. Heavy dressings of salt, are sometimes applied to pasture land to improve the herbage and, kill insects injurious to grass.

200. Salt, is also used, to prevent the too rapid decomposition of organic manure, a purpose for which, in this country, where putrefaction is so rapid, it is much needed; fold-yard manure when stacked in the field decomposes so rapidly, that in a space of four or five months the whole becomes a fine mould which, though valuable, does not serve the same purpose on the land as fold-yard manure in its natural state.

MANURE; AND, THE PRODUCTION OF GREEN FODDER CROPS.

Indian soils becoming yearly less productive, European soils every year more productive.

201. We are frequently informed that, one reason for the wretched condition of agriculture in this country, is, the difficulty of obtaining manure. That, manure cannot be obtained without trouble, and that, its use puts the Ryot to some extra labor, I readily admit. Farming would of course, be a very much easier employment than it is, if all we had to do was, to plough and sow our land and, to harvest and sell our crops; but, in all long-settled countries, the Agriculturist must do a good deal more than this. Unfortunately, in this country, the more rapid is the increase of population, the more rapid is the decrease in the food-producing powers of our soils. As a general rule, the productiveness of Indian soils is yearly decreasing, while, in Europe under the influence of modern farming, the arable soils are yearly becoming more productive.

The free use of manure essential to success in farming.

202. It is, as much the duty of the Ryot to exert himself, in procuring manure for his soil as, it is his duty to plough and sow his land. A Ryot has no more right to expect a fair crop when he applies no manure to his dry land, than he would have had, to expect a good crop, from a sowing of seed scattered over unploughed land. The cost of the manure consists chiefly of expenditure on labor in collecting and bringing manure to the land and, this labor, most Cultivators can themselves perform.

203. I cannot understand why in this country, the farmer should be allowed to do *exactly as he likes* with the land he rents from the State. The rent he pays is, supposed to bear a fixed relation to the crop he produces, which, of course, would be a very fair way of determining the rent, provided, *the land was fairly tilled.* If, the land is only half tilled and, starved as regards manure, the State's share of the produce will appear large, but, let the land be properly tilled and that share at once will bear but, a small proportion to the whole produce. Every Renter of State land should be compelled to use manure; if he does not use it, he is robbing the State for, he carries off far more than he is entitled to. What house-owner would be content with an ordinary rent, from a tenant who, besides availing himself of the usual privileges of tenancy used up in his fires as fuel the window frames, doors, rafters, beams and, other wood portions of the house, and yet, most of the Ryots are dealing quite as badly with the land rented by them from the State: not only are they taking out of the soil, what would be removed under a fair system of husbandry but, they are destroying the natural productiveness of the soil.

There should be some check or control over the farming of the Ryot.

204. It is true that, the permanent exhaustion of arable soil under the influences of cropping, is practically an impossibility; but, it certainly is the case that under injudicious cropping, the productiveness of a soil can speedily be brought down so low as to render the soil not worth cultivation, a state to which, a very large proportion of the arable soils of this Presidency have already sunk.

205. In most civilized countries, tenants are, generally bound to have a considerable area of their arable land annually under what are called restorative crops, such as turnips, green fodder, &c., which must be converted into manure on the farms where produced, by the agency of the live stock. If it is necessary in countries, where agriculture has reached a high state of perfection, to prescribe and enforce regulations for maintaining the fertility of the soil; surely, in this country where agriculture is in the hands of poor, ignorant, superstitious people, it is the duty of the State, to which the land belongs, to prescribe and enforce regulations for the maintenance of its fertility.

In civilized countries Agriculturists not allowed to do as they like with the soil.

206. We have, in this country, many fodder crops eminently suited for general cultivation: why not then, insist upon the Ryot devoting a certain proportion of his land annually to their culture? The proportion to the whole area, need be but small, a sufficient area only, to raise fodder for the working and milch cattle kept on the holding. In this way, a certain quantity of manure would be ensured, and the deteriorating influences, to which the land is now subjected, would, in some measure, be checked. We are told that the ryot cannot afford to grow fodder; my answer is, that he cannot afford to lose his cattle by starvation, or lose their full services, from weakness; and, *that the country cannot afford the cost of periodical famines.*

Compel the culture of fodder crops on all State land.

207. Of course, the cropping of 10 or, 15 per cent., of our arable land by fodder crops would not, altogether render the country independent in an unusually bad

season but, I am convinced that, if a fair proportion of farm yard manure, made by properly fed cattle, was applied regularly to our arable soils, their powers of absorbing and retaining moisture would be greatly increased ; and in this way, vast stores of moisture would be available where now, moisture is almost entirely absent.

208. The question is not whether it will pay the Ryot to grow fodder, any more than it is, whether it pays him to plough his land ; the one duty is, as necessary as the other. It is ridiculous to expect that, the Ryot will obtain a *direct*, return for the fodder he may grow ; the advantages derived from the consumption of a fodder crop on a farm, are never secured in a direct way, or, at once but, they influence for good the whole working of a farm, for years, in many indirect ways, which effects in their aggregate value, exceed the value of any ordinary grain crop, produced under the conditions, common in this country. Under the village system, there would be no difficulty whatever, in determining whether the prescribed area of land was annually cropped with fodder crops.

TOWN REFUSE AND THE PRODUCTION OF FUEL.

209. Nearly all the Municipalities in the plains of Southern India experience great difficulty in disposing of the refuse of their towns. No where in the plains, except to a very limited extent, has the Ryot been induced to cart away town refuse for use as manure. One reason for this is that, in none of these towns have any attempts been made to separate the valuable portions of the refuse, which alone, would bear the cost of cartage. Pieces of bricks, of pan-tiles, bottles, chatties, &c., and similar rubbish mixed with town refuse, greatly reduce its value for agricultural use.

210. I intend in the remarks that follow, only to refer to the heaps of rubbish, which now so frequently disfigure the outskirts of towns. These heaps, having in most instances existed for years, any noxious matter which they may originally have contained, will have become thoroughly decomposed and innoxious.

211. We cannot expect Municipal Corporations to engage directly in agriculture, they have so much to do in attending to the sanitary requirements of their towns ; but, I can see no reason why Municipal bodies should not be extensive holders of fuel plantations, in the working of which they could use up a great deal of the refuse of the town, especially that which has been stored in heaps for a long time.

212. Cheap fuel, is the *one great want of our towns.* At present, fuel is so costly it is utterly impossible to make use of steam machinery which, otherwise might be so usefully employed in raising water, for household use, for flushing drains, &c., &c. *At the present price of firewood in the city of Madras it would require 20 Rupees' worth of firewood to do the work in raising steam that, in England is done by 20 Shillings' worth of coals.* Even setting aside the benefit that would be experienced by the general public, from a reduction in the cost of fuel, the Municipal Corpora-

tions would, themselves, derive much benefit, in the reduced prices they would have to pay for bricks, tiles and lime, for, at present, the expense on account of fuel, *constitutes from* 40 *to* 50 *per cent. of the cost of these materials.* There are many other ways in which Municipalities would directly and indirectly derive benefit, from an abundant and cheap supply of fuel being made available.

Municipalities would be great gainers by having cheap fuel available for use.

213. A great deal might be done by raising fuel trees along the sides of our roads; under proper arrangements, with the aid of manure, a very large quantity of fuel might be produced in this way. If the roadside fuel trees were planted sufficiently close, felling might be begun when they were about one-half grown, every alternate tree being then cut down, and the spaces filled with young trees; in this way, uniformity would be preserved and, the roads would not be disfigured in appearance. The remainder of the first planted trees, might be cut down when matured, and, the spaces, they occupied, might be replanted. If the fuel trees were casuarinas, a crop would in this way be obtained every four or five years, which by the liberal aid of manure and water, there would be no difficulty whatever in securing.

214. Though, a very large quantity of town manure might thus be usefully employed in raising road-side trees, for use as fuel, there would still, in most towns, be a considerable quantity of manure for disposal.

215. Near many towns there is plenty of exhausted arable land available, one or more blocks of which conveniently situated, as regards roads, might be purchased, or hired, by the Municipal authorities. This land, after being heavily manured and, deeply ploughed, might be planted with fuel trees. If properly fenced, the expense of maintaining these plantations would not be great, after, the first two or three years. A dressing of manure, might annually be spread over the ground which, would promote the growth of the trees, and, with the leaves that fall, the indigenous vegetation that will spring up and die on the ground, the soil, after the removal of the trees would be rendered more valuable for agricultural purposes, or, for replanting with trees. Of course, these annual dressings of manure, should be from a compost heap, and not, the fresh night-soil of a town.

Municipal Fuel Plantations.

216. A number of fuel plantations, thus established, in connection with each Municipality, would tend to improve the climate of the neighbourhood; and, when properly situated, and managed, there should be nothing in these plantations to prove injurious to health.

FISH CULTURE.

217. No attention has been given in Southern India, to the artificial propagation of edible fish and, yet there are few countries in which there are such facilities and inducements. We possess vast areas of water in the shape of rivers, tanks and channels over which, Government already has direct control. It is estimated

in America that one acre of water, will produce in fish as much human food as two acres of land. From my experience in the preservation of the portion of the River Adyar which, belongs to the Sydapet Farm Estate, I believe that, under proper arrangements, there would be no difficulty in producing on the average, from 100. to 150 lbs. of fish annually, per acre of water; assuming, of course, that, there are proper facilities for rearing and breeding the fish; that, means are taken to prevent the destruction of spawn and, the young fish, and that, there is sufficient food available for the fish either naturally, or, supplied artificially. It is true that, during the hot season the majority of our rivers, tanks, &c., become dry; but, there would be no great difficulty in providing means for sustaining a large proportion of the fish during the dry season, in all rivers and tanks of any extent; as, in nearly all such there are holes or hollows in which, there is water throughout the year; which, when necessary might, be deepened and extended, and their margins planted around with shrubs and other vegetation, likely to grow in such situations, in view to protecting the fish affording them shelter, and supplying them with food.

218. There are some fine perennial rivers in this Presidency, which might, under proper management, be made to add very materially to the food resources of the country. It would be somewhat difficult at once to stock with new breeds of edible fish, any of these large rivers; but, much benefit would eventually result if, but the most suitable portions only, were stocked.

219. In England, France, America and Australia, Pisciculture is now attracting much attention. In these countries, some most important results have been achieved in re-stocking rivers which, by the neglect of ordinary precautions, had become almost destitute of edible fish.

THE SYDAPET EXPERIMENTAL FARM.

SEASON, &c.

1. The rainfall registered at this Farm, during the past year, was only 38·14 inches, and rain fell only on 54 days. The average annual fall in the ten previous years was 49·39 inches; and, the average annual number of wet days, during the same period, was 71·7. The following statement shows, the quantity of rain registered on each wet day during the year :—

Rainfall registered at the Experimental Farm during the year ending 31st March 1876.

April 1875.	May 1875.	June 1875.	July 1875.	August 1875.	September 1875.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1	1 ... 0·01	1	1 ... 2·31	1 ... ...
2	2	2	2	2	2 ... ...
3	3	3	3	3	3 ... ...
4	4	4	4	4 ... 0·64	4 ... 0·23
5	5	5	5	5 ... 0·87	5 ... ...
6	6	6	6 ... 0·25	6 ... 0·07	6 ... ...
7	7	7	7	7	7 ... ...
8	8	8	8 ... 0·35	8 ... 0·22	8 ... ...
9	9	9	9	9	9 ... ...
10	10	10	10	10	10 ... ...
11	11	11	11	11	11 ... ...
12	12	12	12	12 ... 2·50	12 ... ...
13	13	13	13	13 ... 0·61	13 ... 0·57
14	14	14 ... 0·15	14	14 ... 0·77	14 ... 0·46
15	15	15	15	15 ... 0·10	15 ... ...
16	16	16 ... 0·11	16	16	16 ... ...
17	17	17	17	17	17 ... ...
18	18	18	18	18	18 ... ...
19	19	19	19	19	19 ... ...
20	20	20	20	20	20 ... 2·76
21	21	21	21	21	21 ... ...
22	22	22 ... 0·05	22	22	22 ... ...
23	23	23	23	23	23 ... ...
24	24	24	24	24	24 ... ...
25	25	25	25	25 ... 0·55	25 ... ...
26	26	26	26	26	26 ... ...
27	27	27	27	27 ... 0·39	27 ... 0·19
28	28	28	28 ... 0·06	28 ... 0·11	28 ... ...
29	29	29	29	29	29 ... ...
30	30	30	30	30	30 ... ...
	31		31	31	
Total ... None.	Total ... None.	Total ... 0·32	Total ... 0·66	Total ... 9·14	Total ... 4·21

Rainfall registered at the Experimental Farm during the year ending 31st March 1876.

October 1875.		November 1875.		December 1875.		January 1876.		February 1876.		March 1876.	
	Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
1	... ...	1	... ...	1	... ...	1	... ...	1	... ...	1	... ...
2	... ...	2	... ...	2	... ...	2	... ...	2	... ...	2	... ...
3	... ...	3	... ...	3	... ...	3	... ...	3	... ...	3	... ...
4	... ...	4	... ...	4	... 0·24	4	... ...	4	... ...	4	... ...
5	... ...	5	... ...	5	... ...	5	... ...	5	... ...	5	... ...
6	... 1·61	6	... ...	6	... 1·66	6	... ...	6	... ...	6	... ...
7	... ...	7	... ...	7	... 0·34	7	... ...	7	... ...	7	... ...
8	... ...	8	... ...	8	... 0·10	8	... ...	8	... ...	8	... ...
9	... 0·23	9	... 0·27	9	... ...	9	... ...	9	... ...	9	... ...
10	... ...	10	... 1·65	10	... ...	10	... ...	10	... ...	10	... ...
11	... 0·66	11	... 0·36	11	... 0·10	11	... ...	11	... ...	11	... ...
12	... 0·02	12	... 0·08	12	... ...	12	... ...	12	... ...	12	... ...
13	... ...	13	... 1·00	13	... ..	13	... ...	13	... ...	13	... ...
14	... ...	14	... 7·00	14	... 0·28	14	... ...	14	... ...	14	.. ...
15	... ...	15	... ...	15	... ...	15	... ...	15	... ...	15	... ...
16	... 0·43	16	... ...	16	... 0·27	16	... ...	16	... ...	16	... ...
17	... ...	17	... 0·03	17	... ...	17	... ...	17	... ...	17	... ...
18	... 0·04	18	... 0·10	18	... ...	18	... ...	18	... ...	18	... ...
19	... 0·07	19	... 0·21	19	... ...	19	... ...	19	... ...	19	... ...
20	... 1·18	20	... ...	20	... ...	20	... ...	20	... ...	20	... ...
21	... 0·62	21	... 1·85	21	... ...	21	... ...	21	... ...	21	... ...
22	... 0·18	22	... ...	22	... ...	22	... ...	22	... ...	22	... ...
23	... 0·18	23	... 2·97	23	... ...	23	.. ...	23	... ...	23	... ...
24	... ..	24	... ...	24	... ...	24	... ...	24	... ...	24	... ...
25	... ...	25	... ...	25	... ...	25	... ...	25	... ...	25	... ...
26	... ...	26	... ...	26	... ...	26	... ...	26	... ...	26	... ...
27	... ...	27	... ...	27	... ...	27	... ...	27	... ...	27	... ...
28	... ...	28	... ...	28	... ...	28	... ...	28	... ...	28	... ...
29	... 0·08	29	... ...	29	... ...	29	... ...	29	... ...	29	... ...
30	... ...	30	... ...	30	... ...	30	... ...			30	... ...
31	... ...			31	... ...	31	... ...			31	... ...
Total ...	5·30	Total ...	15·52	Total ...	2·99	Total ...	None.	Total...	None.	Total	None.

2. In the next statement I show, the rainfall in each week of the year, compared with the average weekly rainfall in the previous ten years. I prefer this arrangement to that usually adopted, as it brings out more clearly the character of the seasons :—

Weeks.	1875-76.		Average of the previous ten years.		Weeks.	1875-76.		Average of the previous ten years.	
	Inches.	Wet days.	Inches.	Wet days.		Inches.	Wet days.	Inches.	Wet days.
1st Week ...	...	...	·22	·2	11th Week ...	0·26	2	1·20	2·2
2nd do. ...	...	...	·03	·2	12th do. ...	0·05	1	·32	1·5
3rd do. ...	...	...	·01	·1	13th do. ...	...	...	·57	2·1
4th do. ...	...	...	·01	·2	14th do. ...	0·25	1	·24	1·0
5th do. ...	...	...	1·34	·5	15th do. ...	0·35	1	1·40	2·4
6th do. ...	...	...	·08	·3	16th do. ...	...	...	·91	3·0
7th do. ...	...	...	·04	·2	17th do. ...	0·06	1	1·15	2·6
8th do. ...	...	...	·06	·4	18th do. ...	2·95	2	·67	1·6
9th do. ...	0·01	1	·01	·2	19th do. ...	1·16	3	1·60	2·9
10th do. ...	...	...	1·17	1·4	20th do. ...	3·98	4	·66	2·5

Weeks.	1875-76.		Average of the previous ten years.		Weeks.	1875-76.		Average of the previous ten years.	
	Inches.	Wet days.	Inches.	Wet days.		Inches.	Wet days.	Inches.	Wet days.
21st Week ...	0·55	1	1·40	2·0	38th Week ...	0·27	1	·36	·7
22nd do. ...	0·50	2	1·28	2·4	39th do. ...	...	...	·11	·9
23rd do. ...	0·23	1	1·00	2·3	40th do. ...	...	...	·01	·3
24th do. ...	1·03	2	1·15	2·0	41st do. ...	...	...	·01	·2
25th do. ...	2·76	1	1·58	2·4	42nd do. ...	...	..	·58	·6
26th do. ...	0·19	1	1·21	2·0	43rd do. ...	...	...	·49	·3
27th do. ...	1·61	1	1·46	2·1	44th do. ...	...	...	...	...
28th do. ...	0·91	3	·80	1·6	45th do. ...	...	...	·70	·6
29th do. ...	1·72	4	3·05	3·5	46th do. ...	...	...	·02	·1
30th do. ...	0·98	3	2·97	3·5	47th do. ...	...	...	·13	·1
31st do. ...	0·08	1	1·73	2·2	48th do. ...	...	...	·15	·2
32nd do. ...	1·92	2	2·17	2·4	49th do. ...	...	...	·08	·4
33rd do. ...	8·47	5	2·07	2·7	50th do. ...	...	...	...	...
34th do. ...	5·13	4	3·24	3·3	51st do. ...	...	...	...	...
35th do. ...	...	...	5·49	3·8	52nd do. ...	...	...	..	...
36th do. ...	2·34	4	3·34	1·9					
37th do. ...	0·38	2	1·12	1·7	Total ...	38·14	54	49·39	71·7

3. The following table shows, the rainfall in each month, compared with the average rainfall in the same months during the preceding ten years :—

Months,	1875-76.		Average of the preceding 10 years.	
	Inches.	Wet days.	Inches.	Wet days.
April	...	...	0·26	0·7
May	...	...	1·52	1·5
June	0·32	4	3·26	7·3
July	0·66	3	4·29	9·7
August	9·14	12	4·82	10·5
September	4·21	5	5·23	9·1
October	5·30	12	9·00	11·7
November	15·52	11	13·22	12·6
December	2·99	7	5·66	5·8
January	...	...	1·07	1·4
February	...	...	0·91	0·9
March	...	...	0·15	0·5
Total ...	38·14	54	49·39	71·7

4. During the first four months of the year, the total rainfall amounted to, scarcely, one inch, and there were only seven days on which rain fell, hence, it was impossible to prepare the land for summer crops—cumboo, gingelly, &c.,—which, in this district, are usually sown during June and July. The fall of rain in August was very heavy, however, it was too late to be of any benefit to agriculture further than that it facilitated the preparation of the ground for the cold weather crops. The rainfall of September was unusually light, a large breadth of the land, sown in the early part of the month, had to be resown afterwards, as so many of the young seedlings perished from the effects of the drought and high temperature. The rainfall in October, also, was very light. In November there were several days on which the rain was very heavy; the fall registered on the 14th, was equal to nearly one-fifth of the entire fall of the year; in many localities crops, which had previously been suffering from drought, were much injured by floods. In December, there

were seven days on which rain fell, but as the total quantity amounted only to 2·99 inches, the crops, *which it must be remembered were a month later than usual,* suffered greatly. During the latter half of December and throughout the whole of January, February, and March, there was no rain.

AGRICULTURAL EDUCATION.

Abolition of Apprentice Classes.

5. In previous reports, I have frequently pointed out the great mistake made, in supposing, that the young men, who were in the Sydapet Apprentice Classes could, by mere field training, qualify themselves, as Agricultural Instructors, for employment in parts of the Presidency where the agricultural conditions differ from those met with at Sydapet. In my report for the year ending the 31st of March 1873, I stated " They (the apprentices) certainly learn to copy what they see done on the Sydapet Farms, and they will probably pick up during their apprenticeship enough information, to enable them to conduct successfully small farms, if the circumstances of these Farms are not unlike those of the farms at Sydapet; but, the lads trained under such a system, can never be usefully employed in the Districts, in spreading agricultural knowledge, or in conducting agricultural operations, except those of the simplest kind. * * * * * * * * Mere field training will never fit a man to go into a new district to aid in introducing amongst its cultivators a better agricultural practice. Such training must be supplemented by theoretical teaching in the class-room and in the lecture-room under a definite system which will test the progress made from month to month." Agreeing in these views, Government, sanctioned the abolition of these apprentice classes and, authorized instead the establishment of a School of Agriculture at Sydapet.

The School of Agriculture.

6. The new Institution, will begin work as soon as the necessary temporary accommodation is provided. The permanent buildings will afterwards be erected; they will consist of suitable Lecture-rooms, Class-rooms, &c., a Veterinary Hospital, a Chemical Laboratory, an Agricultural Museum, &c. The Farm will be managed in view to afford every facility for the practical education of the students. The Institution will be attached to the Educational Department, but will be under my direct management. The instruction will extend over three years and will embrace a thorough study of Agriculture and, of such portions of Chemistry, Geology, Zoology, Botany, and the Veterinary Art as bear on the theory and practice of Agriculture; Farm Book-keeping, Land Surveying, and Mensuration.

7. The following are the Lecturers and Masters :—

Lecturers.

William R. Robertson, M.R.A.C., Superintendent, Government Farms	Agriculture.
George Western, M.R.C.V.S., Veterinary Surgeon to the Body Guard of His Grace the Governor	Veterinary.

James Keess, M.D., &c., Professor of Anatomy, Madras Medical College	Zoology.
W. Hamilton, Assistant Professor of Chemistry, Madras Medical College	Chemistry.
R. Wilkins, F.R.C.S., Assistant Professor of Botany, Madras Medical College	Botany.
	Geology.
Charles Benson, M.R.A.C., Assistant Superintendent, Government Farms	Field Experiments and Practical Agriculture.

Masters.

A Ganapathy Iyer, F.A.	Arithmetic and Book-keeping.
T. V. Seetharam Moodelly	Land Surveying and Mensuration.

8. Candidates before admission, must have passed the University Matriculation Examination, the Uncovenanted Civil Service Examination or, the Entrance Examination of the Institution, which is as follows :—

English.—Ability to write correctly and legibly from dictation and express themselves with reasonable correctness and intelligence in a letter or in a report.

Arithmetic.—The first four simple and compound rules, vulgar and decimal fractions.

Vernacular.—Tamil or Telugu (in the case of Europeans and Eurasians only); ability to translate into English easy sentences from an elementary vernacular prose work commonly used in schools.

History.—The leading facts of the histories of India and England.

Geography.—The outline of geography generally, and the geography of India in particular.

9. Stipendiary studentships and scholarships are offered for competition at the nd of the first session.

10. At the opening of the Institution accommodation will be provided for only bout 35 students and for, about a dozen of the students of the Madras Normal School. It is intended to make agriculture a subject of study in the Middle-class nd Elementary Rural Schools of this Presidency, and it is hoped that the young men who are studying at the Madras Normal School, in view to becoming Schoolmasters will, during their attendance at the Agricultural lectures, obtain sufficient nowledge to enable them to teach elementary Agriculture in the schools with which they may afterwards be connected.

11. Europeans, Eurasians, and Natives of all classes are eligible for admission nto the Institution, when vacancies exist, on complying with the following conditions.

12. Candidates who desire to avail themselves of stipendiary studentships or cholarships must be between sixteen and twenty-four years of age, and must produce, with their application for admission, the following certificates :—

(*a.*) Certificate of age.
(*b.*) Do. of character.
(*c.*) Do. of physical fitness.*

* Should state that the candidate has been vaccinated.

ESTATE IMPROVEMENTS.

Removal of the Wudder Settlement.

13. The Wudder Settlement referred to in paragraphs 18 to 21, in my report for 1873-74, was removed from the Farm during the past year. An allowance was given to each hut-owner to meet the cost of removing his hut ; the trees on the ground were valued and compensation was paid to the people who had raised them.

Land for Stock-breeding Experiment.

14. It has been found impossible to secure, at a reasonable cost, the land for a stock farm, referred to at paragraph 62 of my report for 1873-74. Though a large portion of the land is composed of naturally unproductive laterite soils, chiefly held under the "Tope Rules," the sum asked for the right of occupation of the 300 acres was Rupees 10,000, in addition to which, a deduction would have to be made in the quit-rent of the Adyar Zemindary, to which a portion of the land belongs. To fence the ground, make the necessary roads, level the broken surface quarried over in raising gravel, and to carry out other needful improvements, an expenditure of something like Rupees 10,000 would have to be incurred which would bring up the total outlay to Rupees 20,000, at the least. Under these circumstances, there was no choice but to abandon all intention of starting a stock farm, on the land in question, and, there being no other land in the neighbourhood then available, it was determined to utilize for the purpose the land, which, until lately, constituted the Model Farm. Fuel and fruit trees will be planted on the sandiest soils, under the influence of which, these soils will eventually be brought into a better state for cultivation; the other portions of this land, including the portion occasionally submerged when the river is in flood, will be planted with guinea-grass and other grasses, to be grazed by cattle and sheep. The Slaughter yards of the Commissariat Department, which are to be transferred to the Farm at a valuation, will be utilized as stock-yards, for which purpose, they are admirably suited.

TILE-YARD.

Tile-yard.

15. The Farm Tile-yard was fully employed during the past season ; a large number of drain pipes, bricks, and roofing tiles were made. The average cost for making 1,000 bricks of the following dimensions—length 9 inches, breadth $4\frac{1}{3}$ inches, and thickness $2\frac{3}{4}$ inches—was as below :—

	Rs.	A.	P.
Preparing the clay	0	8	0
Conveying the clay to the table	0	6	0
Making the bricks	0	6	0
Removing the bricks to the drying sheds	0	6	0
Cleaning and moving the bricks while drying	0	8	0
Labor at the kiln	0	7	0
Fuel	5	0	0
Add 25 per cent. for superintendence, wear and tear of plant, breakages, &c.	1	14	3
Total ...	9	7	3

16. The average cost for making 1,000 two-inch drain pipes was as below :—

	RS.	A.	P.
Preparing the clay	0	8	0
Removing the clay to the machine	0	3	0
Screening the clay	0	12	0
Making the pipes	1	0	0
Rolling the pipes	0	14	0
Labor at the kiln	0	8	0
Fuel	4	0	0
Add 25 per cent. for superintendence, wear and tear of plant, breakages, &c.	1	15	3
Total ...	9	12	3

17. The average cost for making four-inch drain pipes was about Rupees 15 per 1,000. All the pipes, both two-inch and four-inch, were 1 foot in length.

18. The following shows the cost of 1,000 flat tiles, each 10½ inches long, 7 inches broad, and half an inch thick :—

	RS.	A.	P.
Preparing the clay	0	6	0
Removing the clay to the shed	0	3	0
Making the tiles	0	10	0
Cleaning, moving, and drying the tiles	0	6	0
Labor at the kiln	0	8	0
Fuel	3	0	0
Add 25 per cent. for superintendence, wear and tear of plant, breakages, &c.	1	4	3
Total ...	6	5	3

19. The earth in the tile-yard is well suited for making drain pipes, but it is not so well adapted for making bricks.

BUILDINGS, &c.

Substitution of Tile-roofs for Thatch-roofs.

20. All the sheds at the Experimental Farm, which were roofed with thatch, have been unroofed and tile-roofs have been substituted. I found the thatch-roofs much more costly, than tile-roofs, over a term of years. Even, when placed on brick-in-lime pillars and every precaution taken to keep out white-ants, rats, &c., I found, that thatch seldom lasted more than three years, and as, on the average, it cost 3 Rupees per square, this, in twenty years, would represent an expenditure of Rupees 20 per square of roofing—*more than twice the cost of tiles, which would last, at the least, twenty years.*

Temporary erections costly.

21. The fact is, in Southern India, the best economy in putting up permanent buildings is to use *first class* materials, and to do the work well; the first cost will perhaps be great, but over a term of years buildings so constructed will prove much less expensive than those made of cheap materials. Long droughts, followed by periods in which the

atmosphere is saturated with moisture, attacks of white-ants, &c., prove most disastrous to cheaply put up erections. In the maintenance of such, an annual expenditure of from 20 to 25 per cent. on the first cost, is not at all unusual, which is, about three times the cost of the up-keep of buildings, sheds, &c., that have been built in a substantial manner. Agricultural produce is frequently seriously damaged, from the effects of bad weather, vermin, and other causes, when stored in these so-called cheap structures.

Quarters for the Assistant Superintendent.

22. A residence was built, last year, on the Farm for the Assistant Superintendent. The house is built throughout with brick-in-lime. The wood work is teakwood and benteak. The house contains three large rooms and four small rooms; the large rooms are each about 24 feet long and 16 feet wide. The height of the walls to the wall plate is 11 feet. There is a verandah 8 feet wide at the back and front of the house. The out-buildings consist of coach-house, stable, and kitchens. The total cost was Rupees 4,431-10-7, which, at 10 per cent., represents a monthly rent of Rupees 37, a moderate rent for the accommodation afforded.

A new Barn.

23. A Barn has been erected with the materials of the old engine sheds; these sheds were no longer needed for the purpose for which they were built, and as they were situated within the flood level of the river, they were of but little use. A bullock-power has been erected near the Barn, and it drives a cotton gin, a chaff cutter, a thrashing machine &c.; accommodation is also afforded in the Barn for storing maize cobs, grain in the straw, cotton in the seed, &c., while undergoing preparation for the granary.

Walls made of brick laid in mud are not durable when exposed to the weather.

24. The walls of most of the buildings on the Farm are made of brick laid in mud; they are plastered in the inner side, and the outer side is pointed with lime. In the first cost, such walls are much cheaper than those built with lime, but it is, I think, a mistake to erect buildings of a permanent kind, in such a way. Plastering the outside, preserves such walls, but this, adds materially to their cost. In building with mud, one volume of mud is generally used for about two volumes of brick; it will therefore, be readily understood that, as the mud must expand and contract with every change in the weather, such walls must inevitably crack. In this country, the walls of buildings are frequently exposed alternately, to a deluge of rain, and, to a dry burning atmosphere. Plastering the outer walls of a building does not improve its appearance, but, I fear, there is no choice but to adopt this course when, the bricks are laid in mud.

25. We have made some excellent division walls, for cattle sheds, with 4-inch pipes laid in concrete; such walls, provide for complete ventilation, but they are not adapted for situations in which they will be exposed to rough usage.

Concrete.

26. We find that concrete is admirably suited for making water channels, and, arches over drains; the material is much cheaper than "bricks laid in lime," while it can be worked and laid by ordinary field hands whose labor is, of course, much cheaper than the labor of bricklayers.

LAND IMPROVEMENTS.

27. The surface of a considerable area of the undulating sandy land was levelled to a slope of about 1 foot in 200 feet. On these soils the tillages performed and the manure applied during the past three or four years, had produced but little appreciable benefit. I had, at first, hoped that it would be only necessary to roughly level the surface of such land, but I now see that, we would have gained largely, had we, on first commencing to cultivate these soils, levelled their surface as we have now done.

Chembrumbaukum Channel.

28. The channel, by which it is intended that the Experimental Farm shall obtain water from the Chembrumbaukum Tank, was begun last year, but it is not yet finished. I fear, however, that it will not fulfil the object for which it is intended. It will, I understand, be nearly ten miles in length, and will be merely a dug trench of about 1 foot deep by 1 foot wide. This trench, will skirt a public road for some miles, and will be kept open only with great difficulty and, at much expense.

Sub-soil drained land.

29. The pipes of the land sub-soil drained, continue to work satisfactorily, as far as can be ascertained. During a recent heavy fall of rain, the main pipe was discharging a volume of water nearly equal to its full capacity. It was thought that pipe sub-soil drains would not answer in this country as, white-ants would close them up, however, so far, they do not appear to have done so. The land drained is in a very healthy state, and is greatly more productive and much easier to work, than before being drained.

30. Two nurseries have been established for raising trees, for planting out over the estate. During the last hot season, when, of course, the difficulty of transplanting trees successfully was great, we planted out a number of trees, and, by placing in the soil near each tree a drain pipe, vertically, through which water could be poured into the sub-soil, obtained most satisfactory results. The usual custom when watering, in this country, is to flood the ground around the stem of the tree, in this way forming a basin with a close impervious flooring, through which but very little water can pass, the bulk being evaporated into the atmosphere. When a drain pipe is placed vertically, about a foot into the ground, it enables the water to pass down direct into the sub-soil to the roots of the plant.

LIVE STOCK.

Aden Stock.

31. The imported Aden stock continue to thrive; the cow has had a bull calf by the imported bull, and it promises to be a superior animal; we are now in possession of four pure-bred Aden bulls, which will suffice for the purposes of the experiment.

32. The cows sent to the bulls at the Farm are, generally, very inferior and in poor condition. Native cultivators object to incur any expense when grass is scarce for providing special food for their milch cattle; they argue that, the bullocks pay for their food, in the work they perform, but that, the cow yields milk in such small quantities and over so short a period that, she will not, in her milk, repay the

cost of any special feeding. But there is no good reason why, the cows of this country should not earn their food, by working, at any rate, during the time they are not giving milk. In many parts of Europe, cows are very extensively employed as draught animals. During a month or two before calving and, for three or four months afterwards, it might be inexpedient to work cows, but during six months in the year, they might, as draught animals, earn their food.

Cows as draught animals.

DAIRY CATTLE.

33. In my last annual report at pages 16, 17, 18, and 19, I recorded, in detail, the amount of milk yielded daily by a cow, the daughter of a Nellore cow by a Devon bull. These records, extended only up to six months after calving; the details that follow, show the quantity of milk yielded daily, by the cow, during the entire milking period :—

——	Morning.		Evening.		Total.			——	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINT.		MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINT.
169th day...	2	0	1	6	3	6		211th day ...	2	0	1	5	3	5	
170th „ ...	2	0	1	5	3	5		212th „ ...	2	1	1	4	3	5	
171st „ ...	2	0	1	5	3	5		213th „ ...	2	0	1	3½	3	3½	
172nd „ ...	2	0	1	5	3	5		214th „ ...	2	0	1	4	3	4	
173rd „ ...	2	0	1	5	3	5		215th „ ...	1	7½	1	5	3	4½	
174th „ ...	2	0	1	4	3	4		216th „ ...	1	7½	1	4	3	3½	
175th „ ...	2	0	1	5	3	5		217th „ ...	1	7¼	1	6	3	5¼	
25th week.	14	0	11	3	25	3	76	31st week.	13	7¼	10	7½	24	6¾	75
176th day ..	2	0	1	4	3	4		218th day...	1	7½	1	5½	3	5	
177th „ ...	2	0	1	4	3	4		219th „ ...	1	7½	1	6	3	5½	
178th „ ...	2	0	1	5	3	5		220th „ ...	1	7	1	6	3	5	
179th „ ...	2	0	1	6	3	6		221st „ ...	1	7	1	7	3	6	
180th „ ...	2	0	1	6	3	6		222nd „ ..	1	7	1	6	3	5	
181st „ ...	2	3	1	4½	3	7½		223rd „ ...	1	7	1	6	3	5	
182nd „ ...	2	2½	1	5	3	7½		224th „ ...	1	6½	1	6¼	3	4¾	
26th week.	14	5½	11	2½	26	0	78	32nd week.	13	1½	12	2¾	25	4¼	77
183rd day...	2	2½	1	5½	4	0		225th day...	1	6¾	1	4	3	2¾	
184th „ ...	2	0	1	5	3	5		226th „ ...	1	7	1	4	3	3	
185th „ ...	2	3	1	5¼	4	¼		227th „ ...	1	7	1	4¼	3	3¼	
186th „ ...	2	2½	1	5	3	7½		228th „ ...	1	4	1	2½	2	6½	
187th „ ...	2	0	1	4½	3	4½		229th „ ...	1	2	1	3	2	5	
188th „ ...	1	7½	1	4½	3	4		230th „ ..	1	6	1	4	3	2	
189th „ ...	1	7	1	4¼	3	3¼		231st „ ...	1	6	1	4	3	2	
27th week.	14	6½	11	2	26	½	78	33rd week.	11	6¾	10	1¾	22	½	66
190th day...	1	7½	1	5	3	4½		232nd day ..	1	7	1	4	3	3	
191st „ ...	2	1	1	4½	3	5½		233rd „ ...	1	5½	1	4¼	3	1¾	
192nd „ ...	2	2	1	5	3	7		234th „ ...	1	6	1	4	3	2	
193rd „ ...	2	1	1	4½	3	5½		235th „ ...	1	5½	1	3½	3	1	
194th „ ...	2	2	1	4¼	3	6¼		236th „ ...	1	4	1	3	2	7	
195th „ ...	2	2½	1	5	3	7½		237th „ ...	1	5	1	2½	2	7½	
196th „ ...	2	2	1	4	3	6		238th „ ...	1	5	1	3	3	0	
28th week.	15	2	11	¼	26	2¼	79	34th week.	11	6	10	¼	21	6¼	65
197th day...	2	2¼	1	5	3	7¼		239th day...	1	5	1	2½	2	7½	
198th „ ...	2	2	1	5	3	7		240th „ ...	1	4½	1	2½	2	7	
199th „ ...	2	2	1	4½	3	6½		241st „ ...	1	4	1	3	2	7	
200th „ ...	2	3	1	6	4	1		242nd „ ...	1	6	1	3	3	1	
201st „ ...	2	1	1	5	3	6		243rd „ ...	1	5	1	0	2	5	
202nd „ ...	2	1½	1	6	3	7½		244th „ ...	1	5	1	2	2	7	
203rd „ ...	2	3	1	5	4	0		245th „ ...	1	4	1	2	2	6	
29th week.	15	6¾	11	4½	27	3¼	82	35th week.	11	1½	8	7	20	½	60
204th day...	2	2	1	6	4	0		246th day...	1	5	1	2	2	7	
205th „ ...	2	½	1	7	3	7½		247th „ ...	1	5½	1	2	2	7½	
206th „ ...	1	7	1	6	3	5		248th „ ...	1	4	1	2½	2	6½	
207th „ ...	2	¾	1	6	3	6¾		249th „ ...	1	4	1	2	2	6	
208th „ ...	2	0	1	6	3	6		250th „ ...	1	4	1	2½	2	6½	
209th „ ...	2	0	1	4	3	4		251st „ ...	1	4½	1	2	2	6½	
210th „ ...	2	0	1	6	3	6		252nd „ ...	1	4	1	2	2	6	
30th week.	14	2¼	12	1	26	3¼	79	36th week.	10	7	8	7	19	6	59

——	Morning.		Evening.		Total.			——	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINT.		MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINT.
253rd day...	1	4¼	1	2¼	2	6½		281st day ...	0	7	0	6	1	5	
254th „ ...	1	3½	1	0	2	3½		282nd „ ...	1	0	0	1	1	1	
255th „ ...	1	3½	1	2	2	5½		283rd „ ...	1	3	0	6	2	1	
256th „ ...	1	4	1	2	2	6		284th „ ...	1	0	0	6	1	6	
257th „ ...	1	4	1	2	2	6		285th „ ...	0	7	0	¼	0	7¼	
258th „ ...	1	3	1	1	2	4		286th „ ...	1	4	0	¼	1	4¼	
259th „ ...	1	3	1	1	2	4		287th „ ...	1	0	0	¼	1	¼	
37th week.	10	1¼	8	2¼	18	3½	55	41st week.	7	5	2	3¾	10	¾	30
260th day...	1	3	1	0	2	3		288th day...	0	3	1	1	1	4	
261st „ ...	1	3	1	0	2	3		289th „ ...	0	2½	0	5½	1	0	
262nd „ ...	1	2½	1	½	2	3		290th „ ...	0	4	0	3½	0	7½	
263rd „ ...	1	3	1	0	2	3		291st „ ...	0	5½	0	¾	0	6¼	
264th „ ...	1	2	1	0	2	2		292nd „ ...	0	5½	0	½	0	6	
265th „ ...	1	2½	1	0	2	2½		293rd „ ...	0	6	0	½	0	6½	
266th „ ...	1	2	1	0	2	2		294th „ ...	0	5	0	½	0	5½	
38th week.	9	2	7	½	16	2½	49	42nd week.	3	7½	2	4¼	6	3¾	19
267th day...	1	1½	0	7	2	½		295th day...	0	3½	0	2	0	5½	
268th „ ...	1	2	1	0	2	2		296th „ ...	0	4	0	1	0	5	
269th „ ...	1	2	0	7	2	1		297th „ ...	0	4	0	2	0	6	
270th „ ...	1	0	0	7	1	7		298th „ ...	0	4	0	2½	0	6½	
271st „ ...	1	1	0	7	2	0		299th „ ...	0	3½	0	1½	0	5	
272nd „ ...	1	0	0	7	1	7		300th „ ...	0	4	0	½	0	4½	
273rd „ ..	1	1	0	7	2	0		301st „ ...	0	4	0	½	0	4½	
39th week.	7	7½	6	2	14	1½	43	43rd week.	3	3	1	2	4	5	14
274th day...	1	0	0	7	1	7		302nd day...	0	2½	0	½	0	3	
275th „ ...	1	0	0	7	1	7		303rd „ ...	0	2	0	½	0	2½	
276th „ ...	1	0	0	7	1	7		304th „ ...	0	3½	0	½	0	4	
277th „ ...	1	0	0	7	1	7		305th „ ...	0	3¼	0	¾	0	4	
278th „ ...	1	0	0	7	1	7		306th „ ...	0	3	0	½	0	3½	
279th „ ...	1	0	0	6	1	6		307th „ ...	0	2½	0	½	0	3	
280th „ ...	1	0	0	6	1	6		308th „ ...	0	2	0	1	0	3	
40th week.	7	0	5	7	12	7	39	44th week.	2	2¾	0	4¼	2	7	9

34. This cow, calved on the 6th of February, just about two months after she ceased to give milk. Thus, in the period between her third and her fourth calf, she yielded milk during 44 weeks and, was dry during 8 weeks.

Milk yielded during milking period.

35. Having now obtained records of a complete milking period, we can readily calculate the cost of the milk produced. The total quantity of milk yielded was 1,177 measures and 1½ ollocks or, 3,532 imperial pints. The prices paid for the food of the cow and calf, &c., were similar to those that were paid during the first six months of the experiment, as recorded in paragraph 67 of my last report. The expenditure was as below :—

	RS.	A.	P.
365 days green fodder, 40 lbs. daily, at 300 lbs. per Rupee ...	48	10	8
365 days ground-nut cake, 4 lbs. daily, at 65 lbs. per Rupee ...	22	7	4
365 days bran, 2 lbs. daily, at 32 lbs. per Rupee	22	13	0
Salt, and bedding straw	12	0	0
Attendance	36	0	0
	141	15	0

The total expense thus amounted to Rupees 141-15-0; but, from this must be deducted the sum, Rupees 25, realized by the sale of the calf, leaving Rupees 116-15-0, as the cost of 1,177 measures of milk, equal to one Anna and seven Pies per measure, *which is, about* 50 *per cent. lower than the price at which milk, of very inferior quality, usually sells for, in the larger towns of Southern India.*

Cost of milk produced.

36. A yield of 441 gallons of milk in the year, is very satisfactory, considering the conditions met with in this country. In Ireland, a cow of the Kerry breed, which is the favorite dairy breed in that country, will yield during the year from 450 to 500 gallons of milk. Mr. John Haxton in his book "How to Choose a good Milch Cow" says "Mr. Crosby's dairy of Kerry cows at Ardfort Abbey, near Trallee, averaged 42 in number during the seven years ending with 1861, and averaged 488 gallons of milk a-piece, per annum, during that time, varying from 411 gallons in 1851 to as much as 542 gallons in 1856," and Mr. Morton in his "Hand-book of Dairy Husbandry" says "from these instances, it may be safely gathered that the average yield of well-managed cows varies from 480 to 600 gallons of milk a year, according to breed and size, the Kerry under good management yielding the former quantity, and the Yorkshire, short-horned, and cross breeds the latter."

37. The quality of the milk was, throughout the whole period, exceedingly good, yielding by volume, on the average, from 11 to 15 per cent. of cream.

Quality of milk.

38. A daughter of the cow, last referred to, by a Nellore bull, calved when about three years old. The following registrations show her yield of milk, per week, during her milking period :—

	MRS.	OLKS.	PINTS.		MRS.	OLKS.	PINTS.
1st week	22	1¼	66	25th week	29	7	90
2nd "	30	½	90	26th "	29	1	87
3rd "	29	2¾	88	27th "	29	5	89
4th "	29	3¼	88	28th "	27	3	82
5th "	29	2¼	88	29th "	27	6½	83
6th "	28	4¾	86	30th "	26	5	80
7th "	28	4½	86	31st "	25	4½	77
8th "	28	3	85	32nd "	22	6¼	68
9th "	27	3½	82	33rd "	20	2	61
10th "	27	1½	82	34th "	17	7	54
11th "	26	5½	80	35th "	16	5½	50
12th "	25	½	75	36th "	16	0	48
13th "	28	¼	84	37th "	14	6	44
14th "	26	5	80	38th "	14	1	42
15th "	27	7¾	84	39th "	13	2	40
16th "	28	6¾	87	40th "	14	3½	43
17th "	27	6	83	41st "	13	4	41
18th "	28	2½	85	42nd "	10	7¾	33
19th "	28	5¼	86	43rd "	7	7¾	24
20th "	27	7½	84	44th "	8	0	24
21st "	27	6½	83	45th "	8	6½	26
22nd "	28	3¼	85	46th "	7	2	22
23rd "	29	3	88	47th "	6	1¾	19
24th "	29	7½	90	48th "	5	3½	16

39. Considering the age of the cow, the yield of milk was very satisfactory. This cow had her first calf on the 13th of August when, as before noticed, she

was only three years old. She was milked during nearly 48 weeks, and had her second calf, on the 11th of August following, or scarcely twelve months after the birth of her first calf; thus, *she had had two calves when just four years old.*

Early maturity.

40. I would particularly draw attention to the foregoing facts as, they show how much good, can be effected by using bulls of a superior breed and, by providing suitable fodder and other food in sufficient quantity for the cows throughout the year. As a general rule, *the cows of this country seldom have their first calf until they are five or six years old.*

41. The dairy qualifications of the cows experimented with, I attribute chiefly to the Devon blood, and I am now convinced that it is to the dairy breeds of Europe that, we must look, for the means of effecting improvement in the milch cattle of this country.

42. The ordinary cow of the ryot, when in full milk, seldom gives more than one measure of milk per day, and these cows seldom yield milk for a longer period than six or seven months. As milk, in various forms, occupies an important place in the food of the people of this country, it is highly desirable that steps should be taken to improve the dairy stock.

Milk yielded by country cows.

43. As to the supposed weakened constitution of cattle, the produce of a cross between a bull of an European breed and a cow of an indigenous breed, all I can say is that, the cows, above referred to, have been under my personal notice for nearly four years, during which period they have had no illness whatever. They are generally out of doors all day and, find shelter under trees when the sun is very hot. In the neighbourhood of Madras cows, showing a good deal of the European cross, may be seen out of doors at all hours of the day.

44. I am very strongly of the opinion that bulls of the best dairy breeds of Europe, should be imported by Government, those of Southern Europe direct, and those of Northern Europe from Australia. Some moderately good bulls are now occasionally imported, but, from the small encouragement the importers receive, there is not much prospect of anything important being effected by these means.

Must import bulls of improved dairy breeds.

45. If private agriculturists in Australia, find it worth while, to send agents to England to purchase choice cattle of the best breeds and, ship them on such a lengthy and risky voyage, as that from England to Australia, it is not too much to expect that a Government presiding over a population of 30 millions of people, of whom two-thirds are agricultural, and, possessing a direct annual revenue from agriculture of between three and four millions pounds sterling, should expend a few hundred pounds annually, in introducing bulls of superior dairy breeds, into the country under their jurisdiction.

46. Something is about to be attempted on a small scale, in connection with the Sydapet Experimental Farm, towards effecting some improvement in the dairy stock of this country. The area of land set apart for the purpose is small, but it will suffice for the early requirements of the experiment.

Stock-breeding experiment.

SHEEP.

Chinese sheep.

47. The experiment made with sheep imported from China has proved that, the heat of this climate is too great for the sheep of this breed even when every care is taken to keep them from direct exposure to the heat of the sun. It is, I think, unnecessary to make any further trials with Chinese sheep; the breed, is clearly unfitted for immediate introduction into a hot climate.

Sydapet sheep.

48. The experiment being made with the Sydapet breed of sheep is proceeding as satisfactorily as could be wished. There are now at the Farm some excellent sheep of this breed, and what is equally as satisfactory is, that the sheep are perfectly hardy and quite fitted for the hottest climates. Though, as the experiment proceeds, the quality of the sheep will gradually improve and the good points which characterize the breed will become gradually more fixed, a good many years must yet elapse before the breed becomes thoroughly established. In view to the saving of time, it would, I think, be well to procure from Northern Australia, or Southern Europe, a few rams of a short-woolled breed, in order that an experiment may be made with the rams and a few of the ewes of the Sydapet breed, to determine whether the stages of improvement can be hastened.

POULTRY.

Australian poultry.

49. A number of Brahma-dorking fowls and Aylesbury ducks were imported from Australia. The fowls were inferior to those previously received from that country.

Pekin ducks.

50. The Pekin ducks referred to in paragraph 83 of my last report reached Madras in excellent health: the breed is the finest I ever saw, the birds being more like small geese than ducks. These ducks have been perfectly healthy since they arrived at the Farm; they are very prolific layers, and their eggs are large, some weighing as much as three ounces.

51. A large number of eggs of the imported fowls and ducks, have been sent to different parts of the Presidency, for setting:—

	No.
Brahma-dorking eggs	315
Aylesbury and Pekin duck eggs	402

The average-sized eggs, weighed as below:—

	Weight.	Average weight per Egg.
	ozs.	ozs.
7 Pekin duck eggs	19·03	2·71
5 Aylesbury duck eggs	9·74	1·94
8 Brahma-dorking fowls' eggs ...	13·73	1·71

SPROUTED GRAIN AND PULSE, AS FOOD FOR FARM-STOCK.

52. In a former report, I recommended that in preparing horse-gram as food for cattle, it would be much better, in every way, to steep the pulse in cold water, instead of boiling it. But, " sprouting," is now recommended, as being superior to either " boiling" or " steeping."

53. In England, farmers have long recognized the high feeding value of sprouted grain; but, it is only since the recent alteration in the Excise Laws that, they have been able to make use of it to any extent. Sprouted grain is, grain in a half-malted condition; in malting, germination is encouraged up to a certain stage; when this is reached, the germinating process is suddenly stopped; this is done by exposing the grain to a high temperature in a kiln. During germination, certain chemical changes take place in the seed which, render it more palatable to stock and, more easily digested and assimilated.

54. The grains and pulses of this country have, I find, very different capabilities for absorbing water; the following are the results of some experiments made :—

2 measures of maize placed in a vessel with 2 measures of water absorbed in 14 hours 1 measure of water.

2 measures of horse-gram placed in a vessel with 3 measures of water absorbed in 14 hours 2⅓ measures of water.

2 measures of paddy placed in a vessel with 2 measures of water absorbed in 14 hours ½ a measure of water.

2 measures of cumboo placed in a vessel with 2 measures of water absorbed in 14 hours ½ a measure of water.

55. The steeped grains and pulse, used in these experiments, after being removed from the water, were laid in thin layers and covered over from the light; when examined, 34 hours after, the paddy, horse-gram, and the cumboo were found to be sufficiently germinated for use. For these, it would appear that 43 hours was sufficient for the steeping and germinating process; maize, required some hours longer; but, of course, the length of time needed, depends, greatly, on the condition and age of the seed and, the temperature of the air at the time.

56. Germination should not be allowed to be continued too far. By exposing the sprouted grain, or pulse, to artificial heat, or, to a hot sun, further germination can readily be checked. Sprouted grain, or pulse, would, I think, be particularly suited for young horses that are in the habit of bolting their food only half masticated, as, the sprout will ensure a certain amount of mastication. The sprouting of pulses and grains is, I fear, attended with too much trouble, for the practice to become general, in this country.

PRICKLY-PEAR, AS FOOD FOR STOCK, IN TIMES OF SCARCITY.

57. A small experiment was recently made to ascertain the cost at which the thorns of the prickly-pear could be removed, in order to fit the plant for use in feeding stock. The average result of the trials made, was 120 pounds of prepared fodder, for each Rupee expended on labor. If the coolies had had more experience, there would, I think, have been no difficulty in preparing the fodder at a cost of about 10 Rupees per ton.

Cost of preparing the fodder.

58. Mr. Thomas, the Collector of Tanjore, has frequently directed attention to the importance of utilizing the prickly-pear, as a food for stock when, other food is scarce. I thoroughly agree with that gentleman in thinking, that the prickly-pear ought to be so used, under such circumstances. Of course, I do not recommend the prickly-pear as, being worth the notice of farmers as, a stock food, under *ordinary* circumstances, for, good fodders can so readily be produced, at much less cost.

59. If the thorns could be removed or, crushed by a machine, the cost of the fodder would be very trifling, but it would be difficult to do this by a machine; perhaps something could be effected by passing the plant between rollers, but I fear that the thorns, instead of being crushed, would be simply forced into the fleshy leaf; however, the matter is worth investigation.

Stock will not eat the fodder when first offered.

60. At the Experimental Farm, the prickly-pear, after preparation, was offered to pigs, sheep, and cattle, which all refused it, but I do not attach much importance to this, as domestic stock are generally very conservative in their tastes, frequently refusing food when offered for the first time, of which, afterwards, they perhaps become very fond.

SOILS.

SALT LAND.

61. In my last annual report I referred, briefly, to a small plot, the soil of which had been rendered barren, by an excess of soluble salts. Since then, samples of the soil have been subjected to chemical examination, by Mr. Schiffmayer; the following are the results :—

SOLUBLE SALTS IN THE SOIL.

		Per cent.
Soluble salts in the soil		3·226
Composition of the above—		
Sulphuric acid	(SO_4)	34·16
Silicic acid	($Si\ O_4$)	4·37
Chlorine	(Cl)	20·74
Potassium	(K)	30·99
Sodium	(Na)	
Calcium	(Ca)	2·65
Magnesium	(Mg)	2·80
Ferric oxide	($Fe_2\ O_3$)	1·50
Aluminum	(Al)	Trace
		97·21

62. The following shows the composition of the soluble portion of the efflorescence, which was collected, off the surface of the soil during the hot season :—

		Per cent.
Sulphuric acid	(SO_4)	39·60
Silicic acid	($Si\ O_2$)	0·54
Chlorine	(Cl)	20·30
Potassium	(K)	13·09
Sodium	(Na)	17·48
Calcium	(Ca)	2·59
Magnesium	(Mg)	5·20
Ferric oxide	($Fe_2\ O_3$)	0·54
Aluminum	(Al)	Trace.
		99·34

63. The land, from which these samples of soil were taken, forms a part of the bed of the River Adyar, but is covered by the river only about two weeks during the whole year. Being situated only about 18 inches above the ordinary level of the river, and being surrounded on two sides by a channel connected with the river, the land cannot be sub-soil drained except at a cost out of all proportion to its value. The soil is formed of alluvial silt and the decomposed remains of many successive generations of aquatic plants that have grown and died upon it.

An excess of soluble salt ruins a soil.

64. It will be observed that the soil was found to contain more than 3 per cent. of *soluble* salts, which fact, I think, explains conclusively why the soil is barren, it being well known that a soil which contains more than half a per cent of salts, capable of being washed out by water, cannot possibly be productive, even though it may be rich in the elements of plant food. Hence, we see how important it is that we should know something more of a soil than can be learned from its analysis before, venturing to offer an opinion regarding its fertility. An excess of soluble salt, even of a salt that may possess considerable value, as a manural agent, will cause barrenness instead of fertility.

An analysis alone not sufficient for determining fertility of a soil.

65. The land, from which the samples of soil were taken, might be improved, temporarily, by being heavily manured with fold yard manure and, by being deeply ploughed; but, these influences would operate only for a short time, and would need to be repeated again and again, in order to keep the soil in a condition fit for the growth of crops.

Large area of land rendered unfertile by salt.

66. There is a considerable area of arable land, in this Presidency and, in other parts of India, which has become sterile, apparently from an excess of soluble salts, judging from the periodical appearance on it of an efflorescence during the hot season. An investigation to ascertain the percentage of soluble salts contained in these soils, near their surface, and at a depth of 8 or 10 inches, should be undertaken; it might afford valuable information in indicating which of the soils would be most likely to be ameliorated under the influence of deeper tillage. For example, the surface soil, to a depth of three or four inches, might contain say, one per cent. of soluble salts which, of course, would render the soil unproductive if tilled only to a depth

Some salt soil can be improved by deeper tillage

of three or four inches; but, *if* analysis proved that the strata of soil immediately beneath contained say only a $\frac{1}{4}$ per cent. of soluble salts, it is easy to see, that, to improve the surface soil, it would only be necessary to plough deeply into the lower soil, and, mix it with the upper layer.

BLACK COTTON SOILS.

67. In a letter, No. 532, of the 14th of October last, I applied to the Board of Revenue, for a few fair average samples of the cotton soils, of the Bellary, Coimbatore, Cuddapah, and Tinnevelly Districts. In their Proceedings, No. 9,578, dated the 22nd of October, the Board directed the Collectors of the districts referred to, to procure the specimens of the soils required and, to forward them to Sydapet.

68. Early in December, twelve specimens of cotton soils were received from the Collector of Cuddapah, and Mr. Schiffmayer's services being then available, I gave the samples to him for examination, in view, chiefly, to determine the physical properties of the soils. He selected for examination, the four specimens of the soils referred to in the following statement:—

Number of the sample.	Taluq.	Village.	Land from which the specimen was taken.
1	Jammalamadugu Taluq.	Pedda Pasupula ...	From survey field, No. 320.
2		Jungalapally ...	From survey dry field, No. 475, belonging to the putta of Balagungulugari Gungunna.
3		Chinna Mudium ...	From survey field, No. 63.
4		Pedda Mudium ...	From survey field, No. 329.

He, at the same time, took two samples of the soils of the Experimental Farm, for examination along with the cotton soils; these, were numbered, No. 5 and No. 6.

Organic matter in each soil.

69. The first step, in the investigation, was the determination of the amount of organic matter in each soil. For easy comparison, the organic matter was determined after the soils had been dried to a uniform degree of dryness. The following statement shows, the amount of organic matter found in each soil:—

——	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of soil after heating to 220 degrees...	10·000	10·000	10·000	10·000	10·000	10·000
Weight of soil after combustion of the organic matter	9·397	9·701	9·607	9·425	9·758	9·808
Loss of weight	0·603	0·299	0·393	0·575	0·242	0·192
Organic matter, per cent.	6·03	2·99	3·93	5·75	2·42	1·92

"It will be seen that the organic matter was determined from soils, from which the moisture had been expelled. The results obtained, by adopting this course, are more readily

compared. The percentage of moisture in natural soils is not constant, but subject to great variation from changes in climate. Although these soils were heated, in the sand bath, up to 220 degrees Fahr., the whole of the hygroscopic moisture was not expelled, and the amount of organic matter may be stated a trifle too high."

Capacity to hold water.

70. The next step was the determination of the capacity of the soils to absorb moisture from the atmosphere, when in layers of 0·22 inches deep. The following statement shows this :—

Time when weighed.			No. 1. Weight of soil.	No. 2. Weight of soil.	No. 3. Weight of soil.	No. 4. Weight of soil.	No. 5. Weight of soil.	No. 6. Weight of soil.	Temperature when observation made.	
			Grams.	Grams.	Grams.	Grams.	Grams.	Grams.		
21st January 1876,		9 A.M.	20·000	20·000	20·000	20·000	20·000	20·000	...	In the Laboratory.
Do.	do.	5 P.M.	19·987	19·980	19·983	19 987	19·983	19·958	79	
22nd	do.	7 A.M.	19·990	19·988	19·991	19·991	19·987	19·959	76	
Do.	do.	5 P.M.	20·008	19·996	20·001	20·006	19·985	19·958	79	
23rd	do.	7 A.M.	19·997	19·991	19·998	19·995	19·986	19·958	76	
24th	do.	7 A.M.	19·989	19·991	19·996	19·994	19·987	19·959	76	
25th	do.	7 A.M.	19·996	19·993	19·998	19·999	19·988	19·960	76	
Do.	do.	5 P.M.	20·016	20·001	20·006	20·010	19·987	19·959	79	
26th	do.	7 A.M.	20·013	19·999	20·006	20·013	19·988	19·958	74	Laboratory windows kept open during day and night.
Do.	do.	5 P.M.	19·938	19·970	19·964	19·960	19·962	19·941	79	
27th	do.	7 A.M.	19·916	19·963	19·953	19·945	19·969	19·934	74	
Do.	do.	5 P.M.	19·905	19·953	19·937	19·905	19·960	19·925	79	
28th	do.	5 P.M.	19·856	19·945	19·923	19·894	19·952	19·918	79	
29th	do.	7 A.M.	19·869	19·951	19·926	19·911	19·968	19·931	74	
Do.	do.	5 P.M.	19·914	19·968	19·950	19 935	19 969	19·932	80	
31st	do.	7 A.M.	19·931	19·972	19·960	19·951	19·976	19·935	75	
1st February	do.	7 A.M.	20·664	20·389	20·514	20·574	20·180	20·150	64	Exposed out of door, temperature observed out of door.
Do.	do.	5 P.M.	18·725	19·570	19·280	19·194	19·905	19·870	80	
2nd	do.	7 A.M.	20·323	20·304	20·372	20·377	20·193	20·136	65	
Do.	do.	5 P.M.	18·823	19·628	19·385	19·219	19·892	19·857	84	
3rd	do.	7 A.M.	20·121	20·244	20·300	20·361	20·137	20·092	65	

71. It will readily be understood that, a soil which condenses vapor readily from the air, possesses the means of resisting, to a considerable extent, the effects of a drought. The quantity of this moisture in the soil varies with every change in the temperature, lessening during day, and increasing during night. As the preceding statement shows, the absorption of moisture from the air depends very greatly on the character of the soil.

"For these analyses 20 grams of each soil were taken, and, put separately in zinc trays measuring 4 inches square and 1½ inches in depth, the soils being in layers of 0·22 inches. The soils, while under observation, were kept in the Laboratory for the first ten days and, exposed freely out of doors during the remainder of the period. It will be noticed that, the soils absorbed but little moisture while in the Laboratory, in comparison with what they absorbed when exposed out of doors. Soil No. 1, took up 7·99 per cent. of water during a night."

Capacity to absorb water from a saturated atmosphere.

72. The next stage in the inquiry was, the determination of the capacity of the soils, to absorb moisture from a saturated atmosphere, when exposed, in layers of 0·22 inches deep. The following statement, affords this information ;—

STATEMENT No. III.

——	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of the soils on the 3rd February 1876 at 8 A.M. after exposure to the night air...	20·1215	20·2440	20·3000	20·3610	20·1370	20·0920
Weight of the soils on the 10th February 1876 at 8 A.M. after being under a glass cover for seven days	20·9015	20·3710	20·5550	20·6800	20·1410	20·0930
Weight of the soils on the 14th February 1876 at 8 A.M. after being under a glass cover for eleven days	21·0125	20·3950	20·6330	20·7340	20·1410	20·0780
The soils took water from the atmosphere after being under a glass cover for seven days	·7800	·1270	·2550	·3190	·0040	·0010
The soils took water from the atmosphere after being under a glass cover for eleven days	·8910	·1510	·3330	·3730	·0040	...
The soil No. 6 lost water after being under a glass cover for eleven days	...	...	...	...	...	·0140

"The soils were placed on sheets of glass resting over trays filled with water, and the whole were placed under a glass globe made air-tight. The soils were kept in this way, in the Laboratory for seven days, at the expiration of which time, the cover was removed and the soils weighed. After weighing, the soils were again put under cover, as previously, for four days longer, to ascertain, whether they would take up any more moisture. The temperature under the globe was slightly lower than that of the Laboratory. It will be observed that the absorption of moisture increased in the cotton soils, during the second period of exposure to the saturated atmosphere, whereas the Sydapet Farm's soils, lost moisture. It is probable that these latter had absorbed during the first two or three days of exposure, all the moisture they could condense."

73. The next statement shows, the amount of water each soil contained, after having been exposed to the saturated atmosphere ;—

STATEMENT No. IV.

——	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of the soils immediately after exposure to saturated atmosphere ...	21·0125	20·3950	20·6330	20·7340	20·1410	20·0390
Weight of soil immediately after drying in sand bath, 212 degrees	18·1135	19·3880	19·1730	18·7200	19·8410	19·8160
Water in the soils after exposure to saturated atmosphere per cent.	14·4950	5·0350	7·3000	10·0700	1·5000	1·1150

"Under natural conditions, soils seldom condense so much moisture as in the case of the soils experimented with. The air, is never uniformly saturated, for several days, to the same extent as, the atmosphere over the soils during the experiment."

74. The statement that follows shows, the percentage of water in the soils when taken for the examinations detailed in statements Nos. 2 and 4 ;—

——	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of air dry soil, at the commencement of analysis	20·0000	20·0000	20·0000	20·0000	20·0000	20·0000
Weight of soil after drying in sand bath..	18·1135	19·3880	19·1730	18·7200	19·8410	19·8160
The air dry soil contained per cent. of water	9·4325	3·0600	4·1350	6·4000	0·7950	0·9200

I would particularly direct attention to the above table, it will be seen that, while the sandy soils of the Farm contained on the average only about $\frac{3}{4}$ per cent. of moisture, the cotton soils contained, on the average, nearly 6 per cent. or, in other words, the Farm soil, to a depth of 6 inches contained only about $7\frac{1}{2}$ tons of moisture per acre, whereas, an acre of the cotton soil to the same depth, contained 60 tons, estimating that one acre, of either soil, to a depth of 6 inches, will weigh 1,000 tons.

75. The next statement shows, the capacity of the soils to absorb moisture from the air during the night and, to retain it during the day, when exposed to the atmosphere, in layers of 0·33 inches and 0·66 inches deep;—

Capacity to take up moisture after being manured.

76. The next statement shows, the results obtained with these soils, in the absorption of moisture from the air, when exposed in their natural condition and, when exposed after being mixed with 20 per cent. of organic and, 20 per cent. of mineral manures;—

STATEMENT No. V.

Time when weighed.	Soil No. 1.						Soil No. 2.						Soil No. 3.						Temperature of atmosphere to which the soils were exposed immediately before weighing.
	Layer of Soil 0·33 inches thick.			Layer of Soil 0·66 inches thick.			Layer of Soil 0·33 inches thick.			Layer of Soil 0·66 inches thick.			Layer of Soil 0·33 inches thick.			Layer of Soil 0·66 inches thick.			
	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	
	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	
5-2-76 7 A.M.	30·000	.	...	60·000	..	...	30·000	...	...	60·000	.	...	30·000	..	...	60·000	..	...	75
7-2-76 5 P.M.	28·612	1·388	..	57·447	2·553	..	29·385	·615	...	58·697	1·303	...	28·930	1·070	..	57·898	2·102	..	82
8-2-76 5 P.M.	28·870	...	·258	57·883	...	·436	29 559	...	·174	59·094	...	·397	29·224	...	·294	58·208	...	·310	81
9-2-76 7 A.M.	29·810		·940	58·913	.	1·030	30·089	...	·530	59·936	...	·842	30·014	...	·790	59·290	...	1·082	64
9-2-76 5 P.M.	28·295	1·515	...	56·826	2·087	..	29·265	·824	...	58·727	1·209	...	28·984	1·030	..	57·848	1·442	.	84
10-2-76 7 A.M.	29 559	.	1·264	58·354	...	1·528	30·153	...	·888	59·817	...	1·090	29·950	..	·966	59·156	...	1·308	65
10-2-76 5 P.M.	28·370	1·189	.	56·924	1·430	..	29·413	·740	...	58·794	1·023	..	29·098	·852	...	58·155	1·001	.	81
11-2-76 7 A.M.	29·692	..	1·322	58·480	..	1·556	30·201	...	·788	59·861	...	1·067	30·060	...	·962	59·410	...	1·255	65
11-2-76 5 P.M.	28·700	·992	..	57·346	1·134	..	29·432	·769	...	58·785	1·076	..	28·951	1·109	.	58·050	1·360	...	81
12-2-76 7 A.M.	30·445	..	1·745	59·345	...	1·999	30·620	...	1·188	60·264	.	1·479	30·500	...	1·549	59·802	...	1·752	65
12-2-76 5 P.M.	29·047	1·398	...	58·173	1·172	...	29·683	·937	...	59·291	·973	..	29·397	1·103	...	58·775	1·027	...	82
13-2-76 7 A.M.	30·524	..	1·477	59·826	..	1·653	30·591	..	·908	60·435	...	1·144	30·595	...	1·198	60·158	..	1·383	66
14-2-76 7 A.M.	30·287	·237	...	59·723	·103	...	30·448	·143	...	60·280	·155	...	30·440	·155	...	60·030	·128	...	66
14-2-76 5 P.M.	28·899	1·388	...	58·215	1·508	...	29·614	·834	...	59·244	1·036	...	29·312	1·128	...	58·762	1·268	...	81

Time when weighed.	Soil No. 4.						Soil No. 5.						Soil No. 6.						Temperature of atmosphere to which the soils were exposed immediately before weighing.
	Layer of Soil 0·33 inches thick.			Layer of Soil 0 66 inches thick.			Layer of Soil 0·33 inches thick.			Layer of Soil 0 66 inches thick.			Layer of Soil 0·33 inches thick.			Layer of Soil 0·66 inches thick.			
	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	Weight of Soil used.	Moisture. Loss.	Moisture. Gain.	
	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	
5-2-76 7 A.M.	30·000	.	..	60·000	..	...	30·000	..	...	60·000	...	...	30·000	...	...	60·000	..	...	75
7-2-76 5 P.M.	28·475	1·525	.	57·410	2·590	...	29·806	·194	...	59·492	·508	...	29·767	·233	...	59·494	·506	...	82
8-2-76 5 P.M.	28·720	...	·245	57·677	...	·267	29·871	...	·065	59·654	...	·162	29·819	...	·052	59·460	·034	.	81
9-2-76 7 A.M.	29·960		1·240	58·910	...	1·233	30·072	..	·201	60·006	...	·352	30·050	..	·231	59·988	..	·528	64
9-2-76 5 P.M.	28·944	1·016	.	57·413	1·497	...	29·826	·246	..	59·547	·459	.	29·803	·247	..	59·565	·423	..	84
10-2-76 7 A.M.	30·002	..	1·058	58·757	...	1·344	30·098	...	·272	60·431	..	·884	30·080		·277	60·022	...	·457	65
10-2-76 5 P.M.	29·230	·772	.	57·644	1·113	.	29·861	·237	...	59·056	1·375	.	29·839	·241	..	59·613	·409	...	81
11-2-76 7 A.M.	30·297	...	1·067	58·855	.	1·211	30·100	...	·239	59·452	..	·396	30·081	...	.242	60·030	..	·417	65
11-2-76 5 P.M.	29·138	1·159	.	57·662	1·193	...	99·831	·269	...	58·946	·506	...	29·803	·278	.	59·528	·502		81
12-2-76 7 P.M.	30·632	..	1·494	59·473	..	1·811	30 505	..	·674	59·864	..	·918	30·578	...	·775	60·382		·854	65
12-2-76 5 P.M.	29·316	1·316	...	58·203	1·270	.	29 883	·622	..	59·064	·800	..	29·860	·718	...	59·640	·742	...	82
13-2-76 7 A.M.	30·653	..	1·337	59·765	..	1·562	30·381	...	·498	59·780	...	·716	30·420	...	·560	60·313	...	·673	66
14-2-76 7 A.M.	30·438	·215	...	59·571	·194	...	30·275	·106	...	59·651	·129	...	30·255	·165	...	60·190	·123	...	66
14-2-76 5 P.M.	29·226	1·212	...	58·150	1·421	...	29·867	·408	...	59·034	·617	...	29·838	·417	...	59·612	·578	...	81

STATEMENT No. VI.

Time when weighed.	Soil No. 1. A, in natural condition. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	Soil No. 2. A, in natural condition. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	Soil No. 3. A, in natural condition. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	Temperature.
	Grams.	Grams.	Grams.	Grams	Grams.	Grams.	Grams	Grams.	Grams	Grams	Gms.	Gms.	Grams.	Gms.	Gms.	Grams	Gms.	Gms.	Grams.	Grams	Gms.	Grams.	Grams.	Grams.	Grams	Gms.	Gms.	Gms.
16-2-76 4 P.M. ...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	..	..	20·000	..	...	20·000	...	...	20·000	...	...	80
17-2-76 5 P.M. ...	19·077	·923	..	18·975	1·025	..	19·193	·807	...	19·635	·365	...	19·415	·585	...	19·681	·319	...	19·409	·591	...	19·195	·805	...	19·469	·531	...	82
18-2-76 7 A.M. ...	20·143	..	1 066	20·161	...	1·186	20·265	...	1·072	20·191	...	·556	20·267	...	·852	20·251	...	·570	20·207	...	·798	20·190	...	·995	20·190	. .	·721	65
18-2-76 5 P.M. ...	18·739	1·404	...	18·714	1·447	.	18·974	1·291	...	19·518	·673	...	19·347	·920	...	19·685	·566	..	19·297	·910	...	19·150	1·040	...	19·407	·783	...	83
19-2-76 7 A.M. ...	20·161	...	1·422	20 125	...	1·411	20·225	...	1·251	20·153	...	·635	20·189	...	·842	20·172	...	·487	20·225	...	·928	20·188	..	1·038	20·179	..	·772	68
19-2-76 5 P.M. ...	18·988	1·173	...	18·889	1·236	..	19·103	1·122	...	19·580	·573	...	19·417	·772	..	19·699	·473	...	19·355	·870	...	19·195	·993	...	19·443	·736	...	84
20-2-76 7 A.M. ...	20·451	...	1·463	20·359	...	1·470	20·423	...	1·320	20·271	..	·691	20·345	...	·928	20·273	. .	·574	20·332	...	·977	20·317	...	1·122	20·294	...	·851	66
20-2-76 5 P.M. ...	18·927	1·524	...	18·793	1·566	..	19·000	1·423	...	19·554	·717	..	19·391	·954	..	19·693	·580	..	19·329	1·003	. .	19·153	1·164	..	19·408	·886	...	84
21-2-76 7 A.M. ...	20·383	...	1·456	20·275	...	1·482	20·357	..	1·357	20·226	...	·672	20·284	...	·893	20·224	...	·531	20·290	...	·961	20·265	...	1·112	20·251	...	·843	66

Time when weighed.	Soil No. 4. A, in natural condition. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	Soil No. 5. A, in natural condition. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	Soil No. 6. A, in natural condition. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Moisture. Gain.	Temperature.
	Grams.	Grams	Grams.	Grams.	Grams.	Grams.	Grams.	Grams	Grams.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms	Grams.	Gms.	Gms.	Grams	Grams.	Gms.	Grams	Grams.	Grams.	Grams.	Gms.	Gms.	Gms.
16-2-76 4 P.M. ...	20·000	...	...	20·000	. .	...	20·000	...	...	20·000	..	...	20·000	..	...	20·000	.	...	20·000	...	...	20·000	...	..	20·000	. .	..	80
17-2-76 5 P.M. ...	19·198	·802	...	19·071	·929	..	19·379	·621	...	19·908	·092	...	19·685	·315	...	19·906	·094	...	19·916	·084	. .	19·721	·279	...	19·926	·074	...	82
18-2-76 7 A.M. ...	20·215	...	1·017	20·170	.	1·099	20·287	...	·908	20·086	...	·178	20·164	...	·479	20·091	...	·185	20·082	..	·166	20·170	...	·449	20·111	.	·185	65
18-2-76 5 P.M. ...	19·196	1·019	. .	19·031	1·139	...	19·355	·932	...	19·909	·177	...	19·687	·477	...	19·902	·189	. .	19·916	·166	...	19·622	·548	...	19·930	·181	...	83
19-2-76 7 A.M. ...	20·300	...	1·104	20·119	...	1·088	20·189	...	·834	20·070	...	·161	20·143	..	·456	20·074	...	·172	20·073	...	·157	20·044	...	·422	20·073	...	·143	68
19-2-76 5 P.M. ...	19·262	1·038	...	19·089	1·030	...	19·355	·834	...	19·914	·156	...	19·684	·459	...	19·907	·167	...	19·925	·148	...	19·622	·422	...	19·930	·143	...	84
20-2-76 7 A.M. .	20·455	...	1·193	20·285	...	1·196	20·325	...	·970	20·124	...	·210	20·224	. .	·540	20·154	...	·247	20·136	...	·211	20·132	...	·510	20·151	.	·221	66
20-2-76 5 P.M. ...	19·227	1·228	...	19·081	1·204	...	19·351	·974	...	19·894	·230	..	19·664	·560	...	19·890	·264	...	19·910	·226	...	19·614	·518	...	19·915	·236	...	84
21-2-76 7 A.M. ...	20·406	...	1·179	20·232	...	1·151	20·269	...	·918	20·101	...	·207	20·176	...	·512	20·113	...	·223	20·105	...	·195	20·081	...	·467	20·002	...	·087	66

"Zinc trays, measuring 4 inches square and 1 inch in depth, were used in this experiment. The results in column A, were obtained with 20 grams of soil, those in column B, with 16 grams of soil, mixed with 4 grams of organic matter (saw dust), and those in column C, with 16 grams of soil mixed with 4 grams of mineral manure (cow-dung ashes). The saw dust was taken from a saw pit. It was first steeped for a few days and, afterwards exposed to the sun, in order to hasten decomposition; after drying, it was sifted through a sieve with meshes measuring 0·75 millimeters. It will be noticed that the soils were greatly improved in their powers of absorbing moisture from the air, by being mixed with organic matter, this, was specially the case with the soils of the Sydapet Experimental Farm, *which, after the addition of the organic matter, condensed three times as much moisture from the air, as they were previously able.*"

The results brought to light in this portion of the experiment are of *great practical importance.* They show, that ashes of dung or of any other substance have little or no effect in increasing the moisture condensing powers of a soil. Thus, as regards the soils of the Sydapet Experimental Farm, it will be seen that, while an addition to the soils of 25 per cent. in weight, of mineral manures, produced scarcely a perceptible effect, in increasing their condensing powers, the addition of a similar quantity of organic manure, increased their condensing powers, as Mr. Schiffmayer points out, in the foregoing extract, nearly 300 per cent. Of course, in actual practice, such a quantity of manure as would represent 25 per cent. of the weight of an ordinary soil, 6 inches deep could never be applied at one time; but, under good farming, the organic matter in the soil will gradually increase in quantity. As a general rule native farming, exhausts the organic matter in the soil, and thus, renders the soil less able to take up moisture from the air—*a very serious result in this country.*

Great effect of organic manure in increasing condensing powers of the soil.

Native farming reduces organic matter in the soil.

77. The next stage, in the inquiry, was the determination of the capacity of the different soils to take up water vapor from the atmosphere, when exposed to the air in different degrees of fineness:—

Effect of perfect tillage in the absorptive powers of a soil.

Statement No. VII.

Time when weighed.		Soil No. 1.						Soil No. 2.						Soil No. 3.						Temperature.
		A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			
		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		
			Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.	
		Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	
23-2-76	5 P.M.	30·000	..	...	30·000	...	. .	30·000	...	. .	30·000	...	.	30·000	...	...	30·000	...	.	82
24-2-76	7 A.M.	30·577	...	·577	30·486	...	·486	30·334	...	·334	30·373	...	·373	30·419	...	·419	30·392	...	·392	67
24-2-76	5 P.M.	28·579	1·998	..	28·698	1·788	..	29·444	·890	...	29·162	1·211	...	29·141	1·278	. .	29 096	1·296		86
25-2-76	7 A.M.	30·122	...	1·543	30·146	.	1·448	30·254	...	·810	30 307	...	1·145	30·271	...	1·130	30·204	.	1·108	72
25-2-76	5 P.M.	28·435	1·687	.	28 749	1·397	..	29·410	·844	...	29·237	1·070	...	29·018	1·253		28·950	1·254	. .	85
26-2-76	7 A.M.	29·789	...	1·354	30·019	..	1·270	30·193	...	·783	30·189	..	·952	30·134		1·116	30·051	..	1·101	74
26-2-76	5 P.M.	28 270	1·519	..	28·174	1·845	. .	29·336	·857	. .	28·925	1·264	..	29·022	1·112	...	28·719	1·332	..	87
27-2-76	7 A.M.	29·826	...	1·556	29·834	...	1·660	30·162	...	·826	30·151		1·226	30·177	...	1·155	30·070	...	1·351	72
27-2-76	5 P.M.	28·757	1·069	...	28·914	·920	.	29·622	·540	..	29 507	·644	...	29·381	·796	...	29·390	·680	...	85
28-2-76	7 A.M.	29·802	...	1·045	29·852	...	·938	30·132	...	·510	30·149	...	·642	30·085	...	·704	30 069	...	·679	70

Time when weighed.		Soil No. 4.						Soil No. 5.						Soil No. 6.						Temperature.
		A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			
		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		
			Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.	
		Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	
23-2-76	5 P.M.	30·000	...	...	30·000	...	..	30·000	...	...	30·000	...	. .	30·000	...	.	30 000	...	...	82
24-2-76	7 A.M.	30·466	...	·466	30·427	.	·427	30·166	...	·166	30·171	...	·171	30·157	...	·157	30·180	. .	·180	67
24-2-76	5 P.M.	28·958	1·508	...	29 239	1·188	..	29·841	·325	. .	29·843	·328	...	29·863	·294	..	29·766	·414	...	86
25-2-76	7 A.M.	30·312	...	1·354	30·222	..	·983	30·124	..	·283	30·127	.	·284	30·117	.	·254	30·078	...	·312	72
25-2-76	5 P.M.	28 786	1·526	..	28·724	1·498	...	29·820	·304	...	29·806	·321	...	29·856	·261	. .	29·768	·310	...	85
26-2-76	7 A.M.	30·092	...	1·306	29·962	..	1·238	30·098	...	·278	30·112	...	·306	30·094	...	·238	30·066	..	·298	74
26-2-76	5 P.M.	28·686	1·406	...	28·763	1·199		29·778	·320	..	29·773	·339	...	29 827	·267	. .	29·730	·336	...	87
27-2-76	7 A.M.	30·130	...	1·444	30·081	. .	1·318	30·083	...	·305	30·098	...	·325	30·073	. .	·246	30·026	.	·296	72
27-2-76	5 P.M.	29·209	·921	. .	29·319	·762	...	29 862	·221	...	29·874	·224	...	29·860	·213	. .	29·806	·220	...	85
28-2-76	7 A.M.	30·012	...	·803	30·024	...	·705	30·086	...	·224	30·122	...	·248	30·068	...	·208	30·052	...	·246	70

"The soil, used for the results noted under column A, was sifted through a sieve with meshes of 1·5 millimeters. The other soil, was first sifted through a sieve with meshes of 8·0 millimeters, and, the fine soil was afterwards removed from it by passing it over a sieve with meshes of 6·0 millimeters, that which remained on the sieve, being taken for examination. From those results it will be seen that the fine soils of samples No. 1, No. 3, and No. 4, absorbed more moisture

than the rough portions of the same samples ; and that, the other soils which contained less clay and less organic matter, absorbed more moisture when rough, than when fine."

Capability of air dry soil to hold liquid water.

78. The next statement records the results obtained in an endeavour to ascertain how much liquid water, air dry soils can hold in their pores, when in a natural state :—

STATEMENT No. VIII.

Date of operation.	No. of soils.	Weight of air dry soil.	Water appeared on surface.	Time when weighed after water appeared on the surface.	Weight of the soil at these various times.	Air dry soil held water in its pores.	Soil increased in bulk after saturation.	Soil decreased in bulk after saturation.
		Grams.	Hours.	Hours.	Grams.	Per cent.	Per cent.	Per cent.
5-3-76 ...	No. 1	280·15	8 ¼	½	373·89			
				2	375·60			
				3 ½	377·28	34·67	8·33	
5-3-76 ...	No. 2	338·02	1 ¾	¼	422·03			
				1 ¾	424·02			
				3 ¼	424·36	25·55	0·83	
5-3-76 ...	No. 3	287·35	1 ½	¼	377·99			
				1 ¾	378·05			
				3 ¼	378·10	31·58	4·16	
5-3-76 ...	No. 4	306·79	6 ¼	½	398·86			
				2	400·50			
				3 ½	401·25	30·79	6·66	
5-3-76 ...	No. 5	345 82	1	¼	433·63			
				1 ¾	435·36			
				3 ¼	435·56	25·95		6·66
5-3-76 ...	No. 6	338·54	¾	¼	413·25			
				1 ¾	415·81			
				3 ¼	416·13	22·92		8·33

"The boxes used in these experiments were made of zinc, each measured 6½ inches in depth and were 2·25 inches square. The bottom of each, was perforated with numerous holes, over which was laid a piece of fine linen previously moistened. The weight of the box having been determined, it was gradually filled to 6 inches in depth with soil, and the weight of the whole was again determined. Next, the box with the soil was immersed in water to a depth of 2 or 3 millimeters. It will be seen that, the water moved but slowly upwards in the soils containing most clay and organic matter. *In soil No.* 1, *the water occupied* 8¼ *hours in reaching the surface, while in the soil No.* 6, *of the Sydapet Experimental Farm, it reached the surface in* ¾ *of an hour.* Soils in *a fine state,* will hold more water than soils of which the particles are coarse. Hence, soil No. 2 held less water than soil No. 5, although, the former of these was much richer in organic matter and clay, the good effect of which, was neutralized, by the coarse particles in which the soil was divided, there being necessarily in it much fewer *capillary* tubes. The soils which contained most clay, increased in bulk, while, the sandy soils decreased in bulk. It should be noted, that the figures denote the amount of water the soils held, above that which they contain, in the air dry state; if, the absolute capacity to hold moisture is calculated, the difference between the soils examined, would be much greater than, the figures show."

79. The next table gives the results of an experiment made to determine the readiness with which water evaporates from different soils in their natural condition when saturated to their utmost capacity :—

Statement No. IX.

Time when weighed.	Soil No. 1.			Soil No. 2.			Soil No. 3.			Soil No. 4.			Soil No. 5.			Soil No. 6.			Temperature observed before weighing.
	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	
	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	
Wet soils weigh	377·28	...	...	424·36	...	...	378·10	..	...	401·25	...	...	435·56	...	...	416·13	...	...	
After 24 hours	366·16	11·12	...	408·60	15·76	...	367·25	10·81	..	390·35	10·90	...	421·90	13·66	...	404·58	11·55	...	92
„ 48 „	359·73	17·55	6·43	399·40	24·96	9·20	361·75	16 35	5·54	384·10	17·15	6·25	411·55	24·01	10·35	397·28	18·85	7·30	92
„ 72 „	355·03	22·25	4·70	391·50	32·86	7·90	357·00	21·10	4·75	379·50	21·75	4·60	399·80	35·76	11·75	389·13	27·00	8·15	92
„ 96 „	351·53	25·75	3·50	386·75	37·61	4·75	353·15	24·95	3·85	376·10	25·15	3·40	389·20	46·36	10·60	381·88	34·25	7·25	92
„ 120 „	349·31	27·97	2·22	382·70	41·66	4·05	349·45	28·65	3 70	372·70	28·55	3·40	379·70	55·86	9·50	375·23	40 90	6·65	93
„ 144 „	345·88	31·40	3·43	379 00	45·36	3·70	346·20	31 90	3·25	370·00	31·25	2·70	373 70	62·86	7·00	368·93	47·20	6·30	93
„ 168 „	342·78	34·50	3·10	377·00	47·36	2·00	343·10	35·00	3·10	367·30	33·95	2·70	370·05	65·51	2·65	363·85	52·28	5·08	94
„ 192 „	341·53	35·75	1·25	375·10	49·26	1·90	340·15	37 95	2·95	364·25	37·00	3·05	366 80	68·76	3·25	359·48	56·65	4·37	97
„ 216 „	339·53	37·75	2·00	373·55	50·81	1·55	338·10	40 00	2·05	362·70	38·55	1·55	365·15	70·41	1·65	357·33	58·80	2·15	104
„ 240 „	336·28	41·00	3·25	371·50	52·86	2·05	335·65	42·45	2·45	360·30	40·95	2·40	363·10	72·46	2·05	354·88	61·25	2·45	102
„ 264 „	334·58	42·70	1·70	369·50	54·86	2·00	333·35	44·75	2·30	358·15	43·10	2·15	361·80	73·76	1·30	352·93	63·20	1·95	106
„ 288 „	333·48	43·80	1·10	367·70	56·66	1·80	331·15	46·95	2·20	355·90	45·35	2·25	360·35	75·21	1·45	350·18	65·95	2·75	108
„ 312 „	331·78	45·50	1·70	366·20	58·16	1·50	329·35	48·75	1·80	354·09	47·16	1·81	359·20	76·36	1·15	348·75	67·38	1·43	106
„ 336 „	330·08	47·20	1·70	364·55	59·81	1·65	327·75	50·35	1·60	352·20	49·05	1·89	358·25	77·31	·95	347·38	68·75	1·37	102

—	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Air dry soil held water	34·67	25·55	31·58	30·79	25·95	22·92
Water evaporated during 336 hours	16·84	17·98	17·52	15·98	22·35	20·30
Soil retained absorbed water, after evaporation for 336 hours.	17·83	7·57	14·06	14·81	3·60	2·62
Air dry soil contained water according to Experiment No. III.	9·4325	3·0600	4·1350	6·4000	0·7950	0·9200
Total amount of water in soil, after evaporation for 336 hours.	27·2625	10 6300	18·1950	21·2100	4·3950	3·5400

"The zinc boxes used in the experiments recorded in statement No. 8, were used in the foregoing experiments. The soils, were exposed to the full heat of the sun from 9 A.M. until 3 P.M. daily, for fourteen days. During the remaining part of each day, they were kept in a room before a partially opened window. On one day, the 3rd of April, the soils were kept in the room during the whole day. The temperature was observed daily at 3 P.M., at which time also the soils were weighed. It will be noted that the evaporation was more rapid, the less was the capacity of the soils to hold water. After exposure for 336 hours, soil *No.* 1 *which had taken up* 34·67 *per cent.. of moisture, retained as much as* 17·83 *per cent. and soil No.* 6, *which had taken up* 22·92 *per cent. of water, retained at the same time only* 2·62 *per cent.* Further, the total amount of water in the soil, that is, the water containd in the air dry soil, added to the water taken up in the experiment, was after the expiration of the time mentioned, *in No.* 1, 27·2625 *per cent. while, in soil No.* 6, *it was only* 3·54 *per cent.*, so that, whilst No. 1, was too wet for tillage operations, No. 6, was altogether too dry. All the stiff soils were cracked, especially No. 1, and No. 4, the result of the increase in bulk after saturation and, the subsequent decrease in bulk on drying. The cracks, extended down in the soils to about one-third of their depth, below this, the soils were plastic. The sandy soils on the surface were very hard, the result of their decrease in bulk after saturation; their finer particles having been washed down into the pores, and, the whole cemented together like concrete."

80. The next experiment, was made to ascertain the amount of liquid water, the soil would absorb when mixed with 5 per cent. of organic matter :—

STATEMENT No. X—(*Continued*).

Date.	No. of Soil.	Weight of air-dry Soil.	Water appeared on the Surface.	Time when weighed after the water appeared on the Surface.	Weight of wet Soil at these various times.	Air-dry Soil absorbed water.	Water absorbed by the Soil in the depth of 6 inches is equal to a rainfall in inches.	Soil increased in bulk after saturation with water.	Soil decreased in bulk after saturation with water.	No. of Soil.	Weight of air-dry Soil.	Water appeared on the Surface.	Time when weighed after the water appeared on the Surface.	Weight of wet Soil at these various times.	Air-dry Soil absorbed water.	Water absorbed by the Soil in the depth of 6 inches is equal to a rainfall in inches.	Soil increased in bulk after saturation with water.	Soil decreased in bulk after saturation with water.
		Grams.	Hours.	Hours.		Per cent.	Inches.	Per cent.	Per cent.	No.4	Grams.	Hours.	Hours.		Per cent.	Inches.	Per cent.	Per cent.
22-3-76.	No. 1.	250	9½	½	346·50						260	6¾	½	355·95				
				2¼	348·50								3	357·95				
				5	349·7								5¼	358·85				
				7	350·4	40·16	2·72	3·33	...				7½	359·95				
													9½	360·55	38·67	2·72	1·66	...
22-3-76.	No. 2.	290	2¼	¼	379·88					No.5	280	1¼	¼	376·8				
				2½	380·95								1¾	378·9				
				4½	382·05								3¾	380·4				
				7¼	382·85								6¼	381·4				
				9½	383·85								9	382·1				
				11¾	384·85	32·70	2·57	...	...				11¼	383·0				
													13¼	383·2	36·85	2·79	...	0·83
22-3-76.	No. 3.	250	4¾	¼	338·55					No.6	280.	1½	¼	362·9				
				2¼	339·55								1½	365·9				
				4¾	340·85								3½	367·1				
				7	342·65								5½	367·1	31·10	2·36	...	1·66
				9¼	343·85													
				11¼	344·15	37·66	2·55	0·83	...									

—	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Pe cen t.
Air-dry soil, mixed with 5 per cent. of organic manure held water	40·16	32·70	37·64	38·28	36·85	34·67
Air-dry natural soil held water	34·67	25·55	31·58	30·79	25·95	22·92
Soil after mixed with 5 per cent. of organic manure held more water ...	5·49	7·15	6·06	7·49	10·90	11·75

"These experiments were similar to those of which the results are given in statement No. 8, except, that, only 5 per cent. of organic matter was added to the soils. *It will be seen that the*

water moved more slowly upwards than, in the natural soil; also that, the soils manured, held much more water than the unmanured soil and that, an addition of 5 per cent. of organic matter to the Sydapet soils increased their powers to take up moisture 10 per cent."

Evaporation from soils.

81. The next; and last, experiment was made to determine the readiness with which water evaporated from the different soils when mixed with 5 per cent. of organic manure and, saturated to their utmost capacity :—

STATEMENT No. XI.

—	Soil No. 1.			Soil No. 2.			Soil No. 3.			Soil No. 4.			Soil No. 5.			Soil No. 6.			Temperature observed before weighing.
Time when weighed.	Weight of Soil.	Water evapo-rated.	Water evapo-rated each day.	Weight of Soil.	Water evapo-rated.	Water evapo-rated each day.	Weight of Soil.	Water evapo-rated.	Water evapo-rated each day.	Weight of Soil.	Water evapo-rated.	Water evapo-rated each day.	Weight of Soil.	Water evapo-rated.	Water evapo-rated each day.	Weight of Soil.	Water evapo-rated.	Water evopo-rated each day.	
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	
Wet Soils weigh ...	350·40	..	...	384·85	...	...	344·15	...	...	360·55	...	...	383·2	...	..	367·1	...	..	...
After 24 hours ...	341·20	9·20	...	376·55	9·30	..	331·55	12·60	...	350·75	9·80	...	373·1	10·10	..	354·4	12·70	...	101
Do. 48 do. ...	335·10	15·30	6·10	367·45	18·40	9·10	325·55	18·60	6·00	344·05	16·50	6·70	364·7	18·50	8·40	345·8	21.30	8·60	102
Do. 72 do. ...	330·60	19·80	4·50	357·65	28·20	9·80	320·70	23·45	4·85	339·25	21·30	4·80	354·7	28·50	10·00	336·55	30·55	9·25	105
Do. 96 do. ...	326·90	23·50	3·70	349·35	36·50	8·30	316·75	27·40	3·95	335·25	25·30	4·00	344·7	38·50	10·00	328·30	38·80	8·25	102
Do. 120 do. ...	324·2	26·20	2·70	344·20	41·65	5·15	314·05	30·10	2·70	332·25	28·30	3·00	337·4	45·80	7·30	322·40	44·70	5·90	102
Do. 144 do. ..	321·60	28·80	2·60	339·50	46·30	4·65	311·45	32·70	2·60	329·35	31·20	2·90	330 2	53·00	7·20	317·50	49·60	4·90	101
Do. 168 do. ...	319·5	30·90	2·10	335 95	49·90	3·60	309·25	34·90	2·20	326·45	34·10	2·90	323·3	59·90	6·90	314·10	53·00	3·40	101
Do. 192 do. ...	316·5	33·90	3·00	332·25	53·60	3·70	306·85	37·30	2·40	323·45	37·10	3·00	317·90	65·30	5·40	311·00	56·10	3·10	101
Do. 216 do. ...	314·2	36·20	2·30	329·35	56·50	2·90	304·55	39·60	2·30	320·55	40·00	2·90	314·50	68·70	3·40	308·20	58·90	2·80	104
Do. 240 do. ...	312·2	38·20	2·00	326·95	58·90	2·40	302·55	41·60	2·00	318·00	42·55	2·55	312·00	71·20	2·50	306·10	61·00	2·10	100
Do. 264 do. ...	310·00	40·40	2·20	324·35	61·50	2·60	300·35	43·80	2·20	315·35	45·20	2·65	309·60	73·60	2·40	304·10	63·00	2·00	100
Do. 288 do. ...	309·20	41·20	0·80	323·45	62·40	0·90	299·25	44·90	1·10	313·95	46·60	1·40	308·50	74·70	1·10	303·00	64·10	1·10	89
Do. 312 do. ...	307 30	43·10	1·90	321·75	64·10	1·70	297·45	46·70	1·80	311·85	48·70	2·10	306·30	76·90	2·20	301·10	66·00	1·90	108
Do. 336 do. ...	305·30	45·10	2·00	319·95	65·90	1·80	295·55	48·60	1·90	308·95	51·60	2·90	304·80	78·40	1·50	299·10	68·00	2·00	104

STATEMENT No. XI.

—	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Air dry soil held water when mixed with 5 per cent. of organic manure	40·16	32·70	37·64	38·28	36·85	34·67
Water evaporated during 336 hours	18·04	22·72	19·44	19·84	28·00	24·28
Soil retained from absorbed water after evaporation of 336 hours	22·12	9·98	18·20	18·44	8·85	10·39

"For these determinations the boxes were used that were employed in carrying out the last-mentioned experiments It will be observed that the soils retained more water after evaporation for 336 hours than in the experiment recorded in Statment No. IX, although the temperature was high when the experiment was made. The stiff soils were not cracked and remained more free and open. No. 1, being much more fit for tillage after 336 hours than, in the experiment before referred to, although the soil contained nearly 6 per cent. more of moisture."

82. These experiments are of great practical importance to all engaged in the cultivation of the soil in this country. Much credit is due to Mr. Schiffmayer, for the labor he has devoted to these inquiries and, for the way in which he has conducted them.

Black cotton soil of India and black earth of Russia nearly alike.

83. The origin of our black cotton soils is yet a matter of controversy amongst Geologists, some contend that they are chiefly composed of the residuary matters of decayed forests, while others, assert that, they are aqueous deposits. The late Sir R. Murchison held the opinion that the black earth of Russia which is very similar to the black cotton soils of this country, was deposited under water, and, probably formed the beds of inland seas, the deposit, having been reduced to its present state by atmospheric agencies, during the gradual upheavil of the country. This gradual exposure to the destructive effects of the atmosphere would, he thought, account for the non-appearance in these soils of shells and marine remains. Our black cotton soils, differ from the Russian black earths chiefly, in containing nodular calcareous concretions which, are not found in the latter. The black cotton soil of this country, like that of Russia, is met with on rocks and strata of all ages ; at moderately high elevations, as well as, in low situations ; in beds of from half an acre, to tracts of country of. thousands of acres ; in thickness, varying from 3 or 4 inches to, 20 feet. The general composition of both soils is very similar; the Russian soil is said to be much blacker than its representative, in this country but, this may, to some extent, be due to the greater dryness of the black soil of this country.

Black cotton soil of India sedimentary deposit.

84. It appears to be the opinion of Indian Geologists that, our black cotton soil is, a sedimentary deposit, which has been formed in shallow fresh water lakes ; however, they, are not more able, than was the late Sir R. Murchison, in respect to the black earths of Russia, to bring forward any satisfactory proof.

MANURES.

BRICK-KILN ASHES.

85. Having used with moderately good results, a large quantity of brick-kiln ashes, I was anxious to learn their general composition and, requested Mr. Schiffmayer to submit a sample to chemical analysis which, he accordingly did.

86. The sample, contained 6 per cent. of moisture; 20·60 per cent., of the sample, was soluble in hydrochloric acid, of which 3 per cent. was soluble in

---

NOTE.—The tables and extracts in para. 67 to para. 81 are from a Memorandum prepared by K. Schiffmayer, Esq., Assistan Superintendent, Government Farms.

water; of the 80 per cent., insoluble in hydrochloric acid 10·37 per cent. was soluble in boiling caustic potash; of the remainder, more than 60 per cent. consisted of sand and charcoal. In the portion soluble in hydrochloric acid, he found no less than 3·874 per cent. of phosphoric acid and, a fair percentage of potash, lime and soda.

Large quantity of Phosphoric acid found in ashes.

87. The fuel used, in the kilns is, chiefly wood, and this would not account for the large quantity of phosphoric acid found. It is, I believe, customary to use a small quantity of dried cow-dung fuel, when the kilns are first lighted, but, the quantity used is quite insufficient to account for the large percentage of phosphoric acid.

88. The only explanation that I can offer is, that, probably, the contractor, who, supplied the ashes to the Farm, obtained a portion of them in some "Burning Ground," instead of, from brick-kilns, as stated by him; it is impossible, I think, to account for such a large percentage of phosphoric acid except, on the supposition that, the ashes were those of some animal remains.

VILLAGE NIGHT-SOIL.

89. The night-soil, used in the following experiment was collected in the Wudder Settlement, on the Experimental Farm. Latrines were provided for the use of the people and, a scavenger was employed to collect and remove the solid excreta. At the ground, set apart for the purpose, the excreta was, as gathered, thrown up into a heap, and the whole was covered, each time, with a slight coating of ashes, to prevent any offensive smell. When the heap had accumulated to about 20 or 25 cart loads, it was finally covered with ashes and soil; and, a fresh heap was begun. After lying in the heap for about eight or nine months, the night-soil was found to be quite deodorized and, fit for use in the field. It must be remembered; that *the liquid excreta was not collected, and this, contains* $\frac{5}{6}$ *of the valuable constituents of the whole mixed excreta of man.*

Night soil deodorized after lying in heap for 8 or 9 months.

90. The following are the details of the experiment :—

—	Manured Plot.	Unmanured Plot.
	Yellow Cholum.	
General nature of soil ...	A poor light sandy soil	A poor light sandy soil.
Area of land sown	Half an acre	Half an acre.
Cultivation of soil before sowing.	Twice ploughed and harrowed ...	Twice ploughed and harrowed.
Kind and quantity of manure used.	20 cart loads of night-soil ...	None.
Pounds of seed sown ...	35 pounds	35 pounds.

—	Manured Plot.		Unmanured Plot.	
	Yellow Cholum.			
Date of sowing	14th October		14th October.	
Date of appearance of plants above ground	19th October		19th October.	
Cultivation during growth of crop.	Once bullock hoed and hand hoed.		Once bullock hoed and hand hoed.	
Number of inches of rainfall and number of wet days during growth of crop	Wet days.	Inches.	Wet days.	Inches.
	26	21·29	26	21·29
Date when crop harvested ...	1st February 1876		16th February 1876.	
	Yield of plot.	Yield per acre.	Yield of plot.	Yield per acre.
Weight of grain when fit for market	186 pounds ...	372 pounds ...	193 pounds ...	386 pounds.
	Yield of plot.	Yield per acre.	Yield of plot.	Yield per acre.
Weight of straw when dry ...	3,108 pounds ...	6,216 pounds ..	2,198 pounds ...	4,396 pounds.

91. The plants produced on the manured plot were larger and better developed than those on the other plot; but, there appeared to be fewer of them.

92. On the manured plot the yield of straw was nearly 50 per cent. greater than on the unmanured plot; but, the yield of grain was slightly the heaviest on the unmanured plot.

93. I think it probable that many of the young seedlings were killed by the heavy dressing of manure, from its soluble salts being brought into too great activity by the heavy rains that fell after the experiment began.

94. Other experiments will be made with village night-soil.

GREEN MANURING.

95. The horse gram (*dolichus uniflorus*) is well suited for culture on sandy soils, for ploughing-in as, a green-manure.

96. Last dry season, we raised crops that yielded from 2,000 to 3,000 lbs. of plant per acre in a period of about 12 weeks, during which the rainfall did not amount to 1 inch.

97. In the neighbourhood around Madras, the "summer crops" on dry sandy land, are exceedingly precarious; on the average, we have not more than one year in four, in which, crops sown in June or July, yield returns that repay the expenses of cultivation. I think therefore that instead of attempting to grow "summer crops" such as, gingelly, cumboo, &c., except, on a small scale, on choice land, that, the wisest course after removing the "cold weather crop," would be, to clean the soil thoroughly and, then to sow it with horse-gram, for ploughing-in. These sowings would, in the space of three months, or so, yield per acre from 2,000 to 3,000 pounds of plant which, if ploughed-in, would prepare the soil, admirably, for the succeeding "cold weather crops." The green plant of horse-gram when ploughed-in improves the chemical and physical state of the soil.

Yield of gram plant in a dry season.

Gram a good summer crop for green manuring purposes.

98. When the seed, is drilled in lines, the land can be hoed, by cattle, or, by hand, during the growth of the crop, in this way, the weeds can be kept down, and, the soil maintained in a loose friable condition.

FARM-YARD MANURE AND THE ASHES OF CATTLE DUNG AS FERTILIZERS.

99. In my last Annual Report at paragraph 123, I recorded the results of an experiment made, to determine the weight of farm-yard manure produced by two cattle and, the weight of ashes, made from the dung of two other cattle which were similarly fed and worked, during a period of two months. The following observations refer to another experiment of a somewhat similar kind.

100. The manure collecting part of the experiment began on the 1st of January and terminated on the 31st of March, during which time there was no rain whatever. Four working bullocks were used in the experiment, all were similarly fed and worked, and, at night, all were confined in loose-boxes.

101. The loose-box in which two of the animals were confined was bedded with straw in the usual way; 105 pounds of paddy straw was used for the purpose; and, to this, there would be added, during the experiment, about ten pounds daily, in the shape of waste fodder thrown down and trodden-in by the cattle. The whole of the solid and liquid excreta of these animals was mixed with the bedding; the manure, thus made, was not removed until the termination of the experiment, when the total weight was found to be 3,150 pounds.

102. The other two bullocks had no bedding, their solid excreta was regularly collected and removed; the urine was absorbed by the soil and was lost. The whole of the solid excreta was made into bratties, in the usual way, these, after being thoroughly dried, were burned; the ashes yielded weighed 131 pounds.

103. The result, thus far, was 3,150 pounds of farm-yard manure, made by two bullocks during three months, and, 131 pounds of ashes, obtained from the solid excreta of other two bullocks, during a similar period.

104. A piece of land measuring 2,427 square yards which, had previously been ploughed, was divided into three equal sized plots: to one plot, the farm-yard manure 3,150 pounds was applied; to another plot the ashes, 131 pounds, were applied; and, the other plot was unmanured. The cultivation details were as follows:—

—	Plot No. 1.		Plot No. 2.		Plot No. 3.	
General nature of soil ...	Sandy loam		Sandy loam		Sandy loam.	
Area of land sown	809 square yards ...		809 square yards ...		809 square yards.	
Cultivation of soil before sowing.	Ploughed & ridged ...		Ploughed & ridged ...		Ploughed & ridged.	
Kind and quantity of manure used.	3,150 lbs. of farm-yard manure.		131 lbs. of ashes of bratties.		Not manured.	
Pounds of seed sown ...	20 lbs of yellow cholum.		20 lbs. of yellow cholum.		20 lbs. of yellow cholum.	
Date of sowing	8th April 1876 ...		8th April 1876 ...		8th April 1876.	
Do. of appearance of plants above ground.	13th April 1876 ...		13th April 1876 ...		13th April 1876.	
Cultivation during growth of crop.	Hand hoed		Hand hoed		Hand hoed.	
	Wet days.	Inches.	Wet days.	Inches.	Wet days.	Inches.
Number of inches of rain-fall and number of wet days recorded during growth of crop	25	8·83	25	8·83	25	8·83
Date of first cutting ...	22nd June 1876.		23rd June 1876.		24th June 1876.	
	Per plot.	Per acre.	Per plot.	Per acre.	Per plot.	Per acre.
Weight of fodder from first cutting	4,058 lbs.	10·826 tons.	4,368 lbs.	11·684 tons.	3,140 lbs.	8·578 tons.
Date of second cutting ...	23rd August 1876.		23rd August 1876.		23rd August 1876.	
	Per plot.	Per acre.	Per plot.	Per acre.	Per plot.	Per acre.
Weight of fodder from second cutting	1,680 lbs.	4·4825 tons.	1,176 lbs.	3·037 tons.	896 lbs.	2·197 tons.
Weight of fodder from first and second cuttings.	5,738 „	15·3085 „	5,544 „	14·721 „	4,036 „	10·775 „

105. Unfortunately, we were unable to carry the experiment further; the land, on which the crops were growing, being required to facilitate the carrying out of certain estate improvements.

Ashes gave a quick return; the fold-yard manure acted more slowly.

106. It will be observed that, the first cutting of fodder obtained from the plot manured with the ashes, was heavier, than that which was obtained from the plot manured with farm-yard manure; but, the second crop, was 50 per cent. lighter on the ash manured land than that on the land manured with farm-yard manure. Had the experiment been continued further, I am certain that the farm-yard manure would have shown in a decisive manner its superiority. At the beginning of the experiment the ashes

yielded their full effect; while, the farm-yard manure, acted more slowly. Of course, it would have been better not to have irrigated the plots at all; but the experiment was made in the hot season when water is required for germinating the seed. The experiment was also defective, as a comparative one, from the ash-manured ground not having had applied to it the equivalent of the ash, of the straw used in the manufacture of the farm-yard manure.

CROPS.

GERMINATION OF SEEDS.

107. The following experiments were made by Mr. Schiffmayer to test the powers of seeds to germinate when sown at different depths in the soil :—

When counted.	Maize.						New Orleans Cotton.						Horse Gram.						Wheat.					
	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.
	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.
1875.																								
23rd August ...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	..
24th do. ...	...	...	...	...	...	...	4	...	...	...	...	...	54	4	...	...	...	...	...	...	...	...	...	..
25th do. ...	1	1	...	...	...	...	27	1	...	...	...	...	69	60	35	6	6	6	24	...	...	...	...	.
26th do. ...	8	10	10	2	2	..	37	4	..	...	...	...	70	62	42	15	11	10	70	...	...	...	..	.
27th do. ...	19	40	26	10	8	1	44	18	3	4	...	...	72	68	57	24	21	10	75	40	6	4	1	..
28th do. ...	19	41	29	21	8	1	44	26	16	8	1	1	70	70	57	29	29	13	81	62	21	17	5	2
30th do. ...	23	44	37	27	11	1	50	37	18	9	5	1	73	73	61	39	37	15	91	70	41	19	15	3
31st do. ...	23	44	37	27	11	1	50	37	18	9	5	1	73	73	61	40	38	17	91	70	41	20	15	6
1st September ..	23	44	37	27	11	1	50	37	18	10	5	1	73	73	61	40	38	17	91	70	41	20	15	5
2nd do. ...	23	44	37	27	11	1	50	37	18	10	5	1	74	75	61	40	38	17	91	70	41	20	15	5
3rd do. ...	21	41	34	27	11	1	48	34	17	10	5	1	69	72	58	38	33	16	74	68	41	20	15	5

108. The soil, was dug to the depth of one foot and, was manured liberally with fold-yard manure and ashes. The seed was sown on the 21st of August, at the different depths shown in the foregoing statement. One hundred grains of each variety were sown, except of the wheat, of which, 200 grains were sown. Some of the maize seeds were destroyed by ants, hence, the small number of maize plants. The wheat, did not thrive, many plants perished, evidently from the unsuitability of the season. The beds, were watered every third day. The ground, was hoed on the 2nd of September, and again on the 24th of September.

109. The seed was tested before being sown with the following results ;—

Maize, 75 per cent. of vital seed.
New Orleans cotton, 75 do. do.
Horse gram, 80 do. do.
Wheat, 50 do. do.

110. It will be observed that the maize seed, gave the best results when sown at two inches in depth. When maize is sown at anything greater than 4 inches in depth, the crop, from deficiency of plants, must be a failure. It will be noted that when the seed was sown 2 inches in depth, most of the plants appeared above ground five days after the seed was sown. With the cotton seed, the best results both as regards number of plants and early appearance above ground, were obtained when the seed was deposited only one inch in depth and it will be observed

that the cotton seed is even less able than the maize seed, to produce plants when sown at depths greater than three inches. Of the seeds tested, horse gram appears to be the least affected by differences in the depth at which it is sown; it is remarkable for its rapidity of germination and equally so for its ability to produce plants when sown at a considerable depth in the soil. With wheat, the best results were obtained with sowings at one inch in depth.

111. From these experiments it would appear that most plants are obtained from seed sown at depths of from one to two inches. It must, however, be remembered that, the ground on which the seed was sown was watered every third day and that, it was previously dug over to a depth of one foot, and, was liberally manured; under these conditions it may be wise to sow shallow but, in actual practice, I think, that the best results will be obtained with sowings at from two to three inches in depth; as, the favorable conditions just noticed can seldom be secured to the same extent, in the field.

112. These experiments prove, how fallacious are calculations based on the relation the yield of a crop bears to the quantity of seed sown.

INDIGO SEED.

113. In December last, a gentleman, largely interested in the cultivation of indigo, wrote to me as follows :—

"The indigo plant, produced from the seed hitherto sown by us, viz., the seed raised in the Godavery District, chiefly on islands in the Godavery, is very much inferior to the indigo plant raised from seed imported from Bengal and, the North-West Provinces; and though, the latter, costs three times as much as the Godavery seed, I am importing some."

He forwarded a sample of the Bengal seed and a sample of the Godavery seed. These seeds were subjected to a careful examination; first, the specific gravity of each was determined, these were found to be as follows;—

Bengal indigo seed, specific gravity	1·333
Godavery do. do.	1·270

114. The vitality of the seeds of the two samples was next determined by placing the seeds on blotting paper and keeping them damp in the usual way. The following are the results;—

—	Bengal Seed per cent.	Godavery Seed per cent.
24 hours after the experiment began, there had germinated ...	85	30
48 hours after the experiment began, there had germinated	90	61
72 hours after the experiment began, there had germinated	96	79

THE BAMBOO, AS A PAPER-MAKING MATERIAL.

115. Mr. Thomas Routledge, of Sunderland, England, directed my attention to the bamboo of this part of India as, being worth special culture, for the production of a paper-making material.

116. The bamboo has long been employed by the Chinese and Japanese for paper-making purposes; but, it is only since the discovery of Mr. Routledge's new process of treatment, that it has been found possible in Europe to produce good paper from bamboo fibre at a moderate cost.

Bamboo grows wild in many parts of Madras Presidency.

117. There are in this Presidency large areas of land on which the bamboo grows wild; but, these tracts of country are generally too distant from the coast, to admit of the canes being transported and shipped at a moderate cost; while, as these bamboo jungles are frequently very feverish, there is but little probability that a factory for preparing paper-stock, could be established on the spot and worked with economy.

The common bamboo of the plains not suited for paper fibre.

118. The bamboo (*Bamboosa Arundanacea*) which is found growing singly and in clumps, in so many places in the eastern part of this Presidency, is not suited for cultivation in the way Mr. Routledge advocates; it is too bushy in growth, has too many lateral branches, and is armed with long sharp formidable spines. I forwarded to Mr. Routledge, at his request, a bale of stems and branches of this bamboo, taken from a plant about five years' old which, was growing under ordinary conditions; regarding these samples he writes :—

"The spines, I see clearly, are awkward to deal with, and if bamboo has to be cultivated at all near you it would appear that, owing to these spines, and the bushy habit of the variety, another species should be selected in preference. The stems sent are wholly unsuited for my purpose; they are far *too woody*, whether from age or whether from the nature of the plant, the dryness of the climate, or other reasons I am unable to determine. * * * * * * * I am more and more convinced that it is hopeless to grow bamboo for my purpose, that is, to get abundant crops of young succulent stems in the herbaceous stage, without abundant and almost perennial moisture of soil with good drainage; and if this cannot be secured naturally it must be provided artificially by irrigation as and when required. * * * * * * * * But water, the bamboo must have, not merely to promote rapid and prolific growth, but to ensure soft silky and delicate fibre. Hard, woody, silica coated stems are unsuitable for paper-making or textile purposes."

119. The canes sent to England were fair average specimens of those procurable in this part of the Presidency. The *Bamboosa Arundanacea* is capable of withstanding the effects of a long drought, from its slow growth; while, from this slowness of growth, it produces hard canes that are well suited for use in roofing huts and other similar purposes; but, these qualities are, in the estimation of the paper manufacturer, so many defects in this bamboo, for, he requires a soft-wooded, succulent stem.

120. It is clear, therefore, as Mr. Routledge says, that if we would on this side of India, produce bamboo canes, for manufacture into paper-stock, we must cultivate a species of bamboo that is characterized by rapidity of growth, length, and straightness of stem, and freedom from lateral branches and spines.

121. The climate of the eastern side of the Presidency is not, I think, suited for the successful culture of such a variety of bamboo without the aid of irrigation water; but, so aided, I see no practical reason why, a plantation formed, as

described by Mr. Routledge, should not be worked successfully where there is suitable land and labor available.

Bamboo plantations necessary.

122. To ensure a regular and continuous supply of canes, under economical conditions, Mr. Routledge recommends that, bamboo plantations should be established and worked in the same way as are sugar-cane plantations; and that in connection with these Plantations a Central Factory should be established for the manufacture of paper-stock, in which shape, he would export the bamboo fibre; he recommends, that these plantations should be laid out, and irrigated, in the way practised in cultivating the sugar-cane in Egypt, Spain, and other countries.

Cuttings yield quicker returns than seed.

123. Mr. Routledge advises that, in starting a bamboo plantation, root offsets and stem cuttings of the bamboo should be planted, in preference, to sowing the bamboo seed, as, the former will begin to yield cuttings two or three years sooner than the plants raised from seed.

124. Propagation of the bamboo by stem cuttings, is unknown in this part of India, though, the sugar-cane is always propagated in this way. In a letter of the 15th of November last, in reference to an experiment in bamboo culture being made in Jamaica, Mr. Routledge favoured me with the following extract from a report, dated the 30th of September :—

"The stem cuttings planted on the 29th of July are two feet high and from ½ to ¾ of an inch in diameter, but the root cuttings are from four to five feet high, and, from ½ to 1 inch in diameter. The cuttings from stems planted Chinese fashion, viz., making a hole in the piece of stem between the knots, filling with water, and then lightly covering with earth, does well at first, but always harbours ants; if instead of water the stem had been filled with very damp soil it would nourish the roots and assist in the decomposition of the stem while keeping out the ants."

Experiment with stem cuttings.

125. To ascertain whether the *Bamboosa Arundanacea* could be propagated by stem cuttings, I had a small experiment made with cuttings, taken from various parts of the stem, both of old wood and young wood, and had some of these cuttings planted vertically and others laid horizontally in the soil. The soil, after being planted, was kept in a fair moist condition by frequent irrigation. The cuttings threw out numerous and vigorous shoots which, grew to a height of four feet when, they began to wither at their tips, and continued to do so right down to the main stem. The cuttings, were not removed, and, theground was frequently watered, but, no fresh shoots appeared; when the stem cuttings were raised out of the ground they were found to be almost as fresh and sound as when planted. I reported this result to Mr. Routledge, and in a recent letter he writes :

"I fancy your failure has arisen mainly, if not entirely, from lack of moisture, as your experiment has been corroborated by others made in Jamaica and in Ceylon."

126. I agree with Mr. Routledge in thinking that the chief cause of failure was lack of moisture, not in the soil however, but *in the air*. The weather, during the experiment, was excessively hot and dry and, the sky clear and bright. I have noticed when bamboos are cut down during the hot dry season, that the shoots

which spring up immediately from the roots, frequently die off, on reaching a length of three or four feet, in the same way as did the shoots from the stem cuttings in the experiment.

PRICKLY COMFREY (*Symphytum Asperrimum*).

127. This plant has attracted a considerable amount of attention during the past few months, and, its introduction into India has been the subject of many sensational articles in the newspapers. The assertion, so frequently made, that it is suited for culture in all parts of India is simply absurd; it would be no more ridiculous to assert that because the vine thrives in Southern France it can be grown with success, in all parts of Europe. That the *Symphytum Asperrimum* can be grown with success in some parts of India I am not inclined to dispute, but, a glance at the conditions mentioned by its advocates, as necessary for the successful culture of prickly comfrey will show how very limited must be the area of land in this country that will afford the conditions, even, if favorable climatical conditions can be secured. For instance, " it likes *moist boggy* places," " it needs deep loamy earth, " " the roots will tap down eight feet in *open soil* to moisture, &c., &c."

It needs good deep moist earth.

128. The assertion, that the prickly comfrey will grow and produce good results on any soil, is altogether unsupported by evidence; perhaps, the best work, though now rather old, on matters pertaining to agriculture is " Morton's Cyclopœdia of Agriculture," and, in its article on comfreys we read :—

" It, common comfrey, has, however, fallen into disuse, as well as the two exotic species *S. Asperrimum* and *S. Echinatum*, both which are more productive than our wild plant. The comfreys are of little value, in fact, except in *good deep soil.*"

Long known to British farmers.

129. The *S. Asperrimum* has been known to British Agriculturists for more than 40 years, and it has during these years occasionally attracted attention, but it never established itself in the good opinion of the British farmer. Dr. Voelcker, F.R.S., drew attention to the composition and nutritive value of the prickly comfrey, in a paper, published in volume 7, second series, of the Journal of the Royal Agricultural Society of England, from which I, take the following extracts :—

" The prickly comfrey (symphytum asperrimum) is a native of the Caucasus, whence it was introduced into England, in 1811, as an ornamental plant, by Messrs. Loddige, of Hackney. It is perfectly hardy in Great Britain, a rapid grower, and in moderately good soil reaches a great size; and even in poor soils grows over two feet high. It is a perennial plant, with fine reddish-blue flowers, and as it may be cut down three or four times in one season, it produces an abundance of succulent green food, which is said to be particularly useful for dairy-cows.

" It is conveniently propagated by divisions of the root; the root may be cut into small pieces, as the smallest bit will produce a plant. The best time for planting the root-cuttings is February or the beginning of March ; on good soils it should be planted in rows 2 to 2½ feet apart and 15 to 18 inches apart in the rows. If the plantation is made early in the year and the cuttings strike root and get well established before genial spring weather sets in, it will yield two

good cuttings the first season, and in the succeeding years, if it is kept fairly clean and occasionally manured, it will give three or four cuttings, furnishing an abundance of green food from April to October.

"The prickly comfrey, although first introduced into England, has not much engaged the attention of English agriculturists; but it appears to be extensively cultivated in several parts of Ireland. It was extensively cultivated by the late Bishop of Kildare in a field at Glasnevim, where the plant is still found, growing up as a persistent weed in spite of every attempt to eradicate it. Many gentlemen after the example of the Bishop of Kildare, who was a first-rate dairy-farmer, are reported to cultivate it in their villa or suburban farms around Dublin, and find it very useful food for their dairy stock.

"At first cattle do not like it much on account of the prickly character of its leaves; but they soon get accustomed to it, and are said to do well upon the food.

"Its ordinary produce has been estimated by practical farmers at 30 tons per acre; but in experiments made in Ireland on Carnew Castle Farm on a considerable scale the produce is reported to have amounted to 82 tons per Irish acre in three separate cuttings,—of 28½ tons in the middle of April, 31 tons in the middle of July, and 22½ tons in the middle of September.

"The following figures express the detailed composition of prickly comfrey in its natural state:—

	Per Cent.
Water	90·66
Oil and chlorophyll	·20
* Soluble albuminous compounds	1 10
† Insoluble albuminous compounds	1·62
Gum, mucilage, and a little sugar	1·28
Woody fibre (cellulose)	3·30
Mineral saline matters, soluble in water	1·25
Mineral matters, insoluble in water	·59
	100 00
Containing nitrogen	·175
† Do. do.	·259

"In comparison with other similar food, I may state that comfrey has about the same feeding value as green mustard, or mangold, or turnip-tops, or Italian rye-grass grown on irrigated land."

130. The yield mentioned by Dr. Voelcker is certainly large; it must, however, be remembered that, he refers to the Irish acre, which is, about one-third greater than the Statute acre; deducting, therefore, one-third from the total yield of the three cuttings, the return, per Statute acre, is about 55 tons. The prickly comfrey, it must be remembered occupies the ground a long time before it yields a cutting, while it is a very expensive crop to establish. We have, in this country, crops that will, under favorable circumstances, produce very heavily; amongst these, is the sugar-cane which, in a year, if treated as a fodder plant, will produce under fairly good conditions from 70 to 80 tons of excellent fodder. In my report for the year ending 31st of March 1873, I referred to a crop which, in one cutting, gave a yield amounting to nearly 60 tons, per acre; and this, was produced on a soil of a very ordinary character. Again, Huriallee grass (*cynodon dactylon*) has been known, to yield, under irrigation, during a year, as much as 40 tons of green grass.

We have, on the Sydapet Experimental Farm, with cholum (*sorghum vulgare*) under occasional irrigation produced, in one cutting, as much as 19 tons of excellent fodder, per acre, in a period of less than five months; with Shamay (*panicum miliare*) we have under similar conditions obtained as much as 21 tons of fodder, per acre, in about the same period; and, under dry cultivation, we have with Chinese sugar-cane (*sorghum saccharatum*) produced as much as 11 tons of dry *fodder*, equal to about 15 tons of green fodder, per acre, in a period not longer than 4½ months. There are several other crops cultivated in this country that, will produce large returns of excellent fodder, when cultivated under proper conditions.

131. We are then not, so destitute, in this country, of plants suited for raising fodder nevertheless, it would be a decided gain, to add to the list of our fodder crops the prickly comfrey if, only one-half that has been said in its praise, is true. We cannot hope to see it growing successfully in the plains of Southern India but, on the Nilgiris, Shevaroys, in Wynaad, Coorg and other hill tracts of this Presidency, as well as, on the higher table-lands of Mysore, the prickly comfrey, might be expected to produce good results.

CROPS.

PLANTAINS.

132. In August 1872, 560 plantain sets, were planted on a piece of ground measuring half an acre. The plot was gradually increased as plants were available. On the 21st of October 1873 there were in all 1,250 plants, and, on the 31st of March following the number was 1,990. On the 5th of May 1874, 718 plants in full bearing were destroyed by the cyclone which then broke over this district thus, leaving only 1,272 plants ; most of which were seriously injured. The plants broken down, during the cyclone, were removed and, 700 young plants were put in their places. During 1874 and 1875, the plot was still further increased as plants were available ; at the end of March 1876, the number of plants on the ground was 3,530 of which, 156 were young plants substituted for 156 plants which, when in full bearing, were destroyed by a storm, in June 1875.

133. In May 1876, the land, on which these plantains were growing, being needed for other purposes, the experiment was closed. The produce of the plot was, altogether 1,776 bunches of plantain fruit, which, with leaves, &c., realized Rupees 375-7-10; valuing the plants on the ground, at the close of the experiment, at Rupees 100, the total value of the produce would amount to Rupees 475-7-10.

134. The return would have been much larger, had not the cyclone in 1874, and, the storm, in June 1875, committed so much damage. Valuing the trees actually broken down, at these times, at 4 Annas each, which price, had been offered for them, the loss, was upwards of Rupees 200, without taking into account the damage sustained by the plants which, were left standing.

135. The area of ground actually cropped would be in 1875 and in 1876, 3 acres ; in 1874, 1¾ acres ; in 1873, 1 acre; and in 1872, ½ an acre ; and, for these 6¼ acres rent would be chargeable for one year. The expenditure was as follows :—

	RS.	A.	P.
Cost of plantain plants	51	7	7
„ of pitting, planting, and manuring	60	7	0
„ of manure	53	5	0
„ of watering	172	2	0
„ of tillage, weeding, watching, &c.	127	1	0
	464	6	7

136. Nearly two-fifths of the entire expenditure was for watering the plants, as the water had to be raised from a depth of 18 feet; an expenditure which, represents a charge of about 28 Rupees per annum, per acre cropped. In favorable situations, where water can be obtained by gravitation, or, is only to be raised to a moderate height, the charge for water and watering would be very small.

137. The manure used, was almost entirely compost manure, made of the blood refuse of the slaughter-house, and ashes. The effects produced by this compost were most satisfactory, the bunches of fruit were large and, the fruit was well flavored.

Large yield of land under a plantain crop.

138. Though, the soil was very sandy it produced, under the plantain, a very heavy crop. Ten plantain trees, of fair average size, were found to weigh 994 lbs. or, about 99 lbs. each, and as, these were planted at distances of 6 feet apart, there would be 1,210 trees per acre; equal to, about, 53 tons weight of plants per acre.

BRINJALS (*Solanum Melongena*).

139. This crop, which is cultivated to some extent in many parts of Southern India, was grown experimentally on the Sydapet Farm last year. As I have not in any previous Annual Report referred to this crop, I record the following results. The cost, in each instance, is the actual cost, as taken from the Farm cultivation Book:—

PLOT I.

Area of plot	1 Acre.
Date of planting	11th March 1875.
Date of harvesting	May 15th to Oct. 10th.

Cultivation Expenses.

	RS.	A.	P.
Seedlings; value of	1	8	0
Manure; 600 lbs. of oil-cake at 100 lbs. per 1 Rupee, and, 6 loads of farm manure at 12 Annas per load	10	8	0
Cattle labor; in ploughing and working the land 6½ pairs of cattle, with drivers, at 12 Annas per day	4	14	0
Watering; 14 waterings at 1 Rupee each	14	0	0
Manual labor; planting seedlings in the field, spreading manure, &c., 11 men, at 3 Annas per day	2	1	0
Hand-hoeing and digging during growth of the crop; 43 men at 3 Annas, 5 women at 2 Annas, and 2 boys at 1½ Annas per day ...	8	14	0
	41	13	0

As, the effect of the manure would operate over, at the least, three years, two-thirds of its cost must be deducted, thus reducing the cultivation expenses to Rupees 34-13-0. The plants, began to bear in May and, continued to bear until the end of October, during this period the total weight of fruit gathered was 3,168 lbs. which, was sold, in the field, at an average of 7½ pies per viss, realizing Rupees 41-4-0.

PLOT II.

Area of plot	2,068 square yards.
Date of planting	20th April 1875.
Date of harvesting	June 7th to Nov. 9th.

Cultivation Expenses.

	RS.	A.	P.
Ploughing	3	0	0
Manuring and planting	2	14	0
Watering	11	0	0
Hoeing	1	12	0
Manure, 10 loads of farm-yard manure	5	0	0
	23	10	0
The crop was sold in the field for	45	1	6

RHEEA (*Boehmeria nivea*).

140. In November last, 100 roots of the rheea plant, were received from the Superintendent of the Botanical Gardens, Saharanpore, North-West Provinces. The roots, were much out of rcondition on eaching Sydapet, from the length of time (a week) occupied in transit. They were planted out at once, a considerable number of them grew and produced healthy plants but, during the hot season the leaves of most of the plants became so bleached and discolored, apparently from the high temperature at the time, it was deemed necessary to remove the plants to a plot of ground somewhat more shaded from the sun. The change was beneficial, the leaves assumed a healthy green color. A number of the plants were forwarded to the Collector of Coimbatore who, intends making some experiments with rheea. I fear that, there is but little probability, at present, of the rheea plant being cultivated successfully in this part of India, even, in localities where favorable climatical conditions can be met with, for, the plant requires, for its healthy growth, a very large quantity of potash and phospheric acid and, these mineral foods are now found in exceedingly small quantities in our ordinary arable soils, and ryots never apply manure that restores either.

High temperature injurious.

Needs a good soil.

GROUND-NUTS (*Arachis hypogea*).

141. The ground-nut is not cultivated to a great extent in this country but, there are a few localities in which the crop occupies a considerable area of ground. It requires a porous healthy soil, rich in potash, lime, &c. As generally cultivated

it is a very exhausting crop, and frequently repeated, rapidly reduces the fertility of a soil; however, if the cake, made from the crushed nuts, in extracting the oil, was given to the live stock on the Farm on which the nuts were raised, there would be but a small loss of fertilizing matters. But usually, the ryot sells the whole of the nuts he produces; and never gets back the cake for feeding his stock. The result of this is, that the soils, on which the ground-nut is cultivated, are becoming poorer and poorer every year, the fertilizing matters which, they lose, being turned to good account in the coffee estates of this country and Ceylon; and, in England and France to which countries the ground-nut is now largely exported.

Lime needed.

142. On two, or three, occasions small plots on the Experimental Farm were planted with ground-nuts but, the results obtained were unsatisfactory; there was always an abundance of leaf and stem but, the yield of nuts was exceedingly small. I attribute this to the absence of lime in the soils of this farm. A small experiment is being made to test whether when lime is added to the soil the plant will produce more abundantly.

143. The best manure, that could be used for this crop would be the dung of animals that have been fed on ground-nut cake; but, this would not return to the soil all the manural matters removed by the crop; the husks of the nuts, separated in shelling, should also be returned to the soil for, they are rich in fertilizing matters.

NEW ORLEANS COTTON.

144. New Orleans cotton, has been grown on this farm, with a fair amount of success, during the past three or four years, though, the soils are naturally very poor. It was only by good tillage and by the judicious use of manure that fair results were obtained. A return, of 150 to 180 lbs. per acre of clean lint, in addition to a fair crop of maize, grown in alternate lines with the cotton plants, was repeatedly obtained.

Suitable for high culture.

145. This species of cotton, in some respects, is adapted for high cultivation in this part of India; under the influences of manure, indigenous varieties of cotton produce a great deal of wood and leaf but, the New Orleans species yields a liberal return, in lint, for any manure that is applied to it.

146. In its own country, the New Orleans plant comes much quicker to maturity than it does in this country; to some extent this is due to the different climatical conditions it has to encounter in the two countries, as, is shown in the following tables:—

Meteorology of the Cotton-producing Areas, in New Orleans, during the period in which Cotton is growing.

Months.	Maximum Temperature.	Minimum Temperature.	Rainfall.
			Inches.
April	83	46	3·75
May	92	61	1·90
June	91	73	2·30
July	95	72	6·00
August	92	75	5·40
September	88	66	1·30
October	85	54	0·30
November	82	38	6·55
December	74	25	8·45

Meteorology of the district around Madras, during the period in which Cotton is growing.

Months.	Maximum Temperature.	Minimum Temperature.	Rainfall.
September	99·4	72·4	4·78
October	96·3	70·4	12·66
November	90·6	67·5	18·08
December	87·8	63·9	4·91
January	87·2	61·4	0·09
February	91·3	64·4	1·31
March	95·1	65·1	0·47
April	101·1	72·7	0·76
May	105·2	74·4	2·50
June	104·0	74·7	2·08
July	102·4	74·2	4·35
August	99·2	73·5	4·42

147. It will be observed that, the temperature of Madras is much higher than the temperature of New Orleans; also that, in New Orleans the temperature in December sinks below the freezing point which, of course, puts a stop to all vegetation. In New Orleans, the producing capabilities of the cotton plant are therefore more concentrated, from the shorter season in which the plant bears. In Madras, on the other hand, we have no such complete cessation of vegetable energy, excepting, during an unusually long drought; thus, we have *no definite harvest time* for our cotton, a gathering being afforded, after every heavy fall of rain succeeded by bright hot weather.

148. From the causes just noticed we are put to a much greater expense in harvesting cotton than, the planter in New Orleans; he, seldom puts his people to gather until each can collect, in a day, from 40 to 50 pounds of seed-cotton; and, in eight or ten successive gatherings, he harvests his whole crop. We, are obliged frequently to harvest a gathering when, it is as much as a cooly can do to gather five pounds of seed-cotton in a day, and as, we may have probably twenty gatherings, at the least, to make in the year, the cost of harvesting the cotton is exceedingly heavy.

Cost of harvesting cotton expensive from no harvest season.

149. On this farm, we sow New Orleans cotton in the month of September; during the three following months its growth is rapid from the heavy rainfall of the monsoon but, there being but little rain during January, February, March and

April the growth of the plant during these months receives a serious check; in May, June and July, if the rainfall is favorable and the weather bright several fair gatherings of cotton are obtained but, it is seldom that the yield obtained by the end of July, is such, as to justify the removal of the plants, in clearing the ground for another crop; hence, the plants are generally allowed to stand on the land until, the end of September. In August, when the weather is bright with occasional showers, a considerable gathering of cotton is obtained which, makes the yield of the crop much more respectable than, would have been the case, had the cotton plants been cut down in July; but, there is a great deal of uncertainty attending the harvesting of cotton in August, for, if the weather is dull and cloudy as it sometimes is, the cotton boles do not burst freely and, become infested with insects which, greatly injure the quality of the lint; while, the lint is shorter than, in the early part of the season. And, a further objection to keeping the cotton plant on the land, so late in the season is, that the soil cannot be cleaned and prepared, in a satisfactory way, for the cold weather crop to follow.

Dull weather injurious to cotton at harvest time.

150. Some improvement might be effected, by sowing the cotton seed in August or, even in July, when the state of the weather admits, the plant would thus begin to bear in the beginning of December.

151. I will try an experiment with New Orleans cotton under occasional irrigation; by rendering the plant independent of the weather, it may be induced to alter its bearing season.

152. I see no prospect of any success attending the cultivation of New Orleans cotton plant, in this Presidency unless, under good cultivation; tillage and manure are indispensable.

Tillage and manure indispensable for New Orleans cotton plant.

153. It is much to be regretted that in most parts of this Presidency cotton land is never manured, crop after crop is removed without a particle of manure being applied to the soil. The fertility of cotton land, might be prolonged to an indefinite period, would the ryot but use the cotton seed in feeding his stock and, apply their dung to the soil which yielded the crop; but, he never thinks of so using the cotton seed except, to a very limited extent, and then, the manure is applied only to his garden crops. Cotton lint removes but little from the soil; the loss of fertilizing matters is due to the removal of the plant and seed. The plant is, in most instances, taken to the villages and used as fuel, but it is seldom that the ashes made, ever find their way back to the soil, on which the cotton plants were raised.

Cotton not an exhausting plant under good farming.

LIVE FENCES.

154. During my tour, in Coimbatore, I saw in the neighbourhood of Avenashy and, in some other places, some excellent fences which had been formed by planting cuttings of the branches of a thorny tree called in tamil, "Moolloo Kiloovay." The cuttings readily take root on being planted, and, at once form a fence.

155. I had a quantity of the branches of this shrub sent to Sydapet where they are now growing; from these, I hope next year to get enough cuttings to establish a fence which, in its turn, will provide cuttings for making other fences, and, in

this way, a new fence shrub will, I trust, be introduced into general use in this part of the Presidency.

156. During the same tour, I procured a quantity of the seed of a very thorny shrub, one of the acacias, which, I found growing on the dry almost sterile land between Mettapollium and Nellithoray. The shrub, is of a moderate height, is thickly covered with branches which, are armed with the most formidable thorns I ever saw.

157. We have recently established corkapilly fences, by planting in manured trenches the root cuttings from old corkapilly fences; the results, so far, have been all that could be desired; the stems root at once, and immediately begin to throw out branches. I have no doubt but that we will be able, under this system, to establish a useful fence in a period of less than six months. Under ordinary circumstances, corkapilly fences, started from seed, are of little use until two years old, and then only, when they have been attended with great care.

CROPS RAISED FROM IMPORTED SEED.

AUSTRALIAN SEEDS.

158. In September last we received from Australia, a small supply of agricultural seeds; these consisted of Chinese sugar-cane, planters' friend, maize, of three varieties, prairie grass, buffalo grass, osage orange, &c.

159. Most of these seeds were sown on the Experimental Farm, for producing seed for distribution. Some of the crops raised from them, were very good and, a large quantity of excellent seed was obtained.

160. The following, will afford information regarding the general results obtained with some of these Australian seeds :—

CHINESE SUGAR-CANE (*Sorghum Saccharatum*).

General nature of soil	Sandy loam.
Area of land sown	6,294 square yards.
Cultivation of soil before sowing	Three times ploughed, harrowed and ridged, and, again ridged by splitting the ridges over the manure.
Kind and quantity of manure used	35 cart loads of farm-yard manure, and 20 lbs. of guano spread uniformly in these furrows between the ridges.
Pounds of seed sown	14 pounds.
Date of sowing	7th of October.
Date of appearance of plants above ground ...	12th of October.
Cultivation during growth of crop	Twice hand hoed.
Number of inches of rainfall, and number of wet days recorded during growth of crop ...	27 wet days; 21·31 inches.
Date when crop harvested	20th of January 1876.
Weight of grain when fit for market	1,468 pounds.
Weight of straw when dry	11,648 pounds.

161. A yield, per acre, of 1,128 pounds of grain, and 8,969 pounds of straw is, a very satisfactory one. The grain, was quite as good as that received from

Australia. The crop was healthy throughout the whole period of growth; and was not irrigated.

162. However, it is not for the production of grain that, I recommend Chinese sugar-cane to the notice of farmers in this country; we, allowed the crop to produce grain, simply, because seed was required for distribution, but, in general cultivation the crop should be cut down when in flower, in order to secure the fodder in the best condition; only a few plants being allowed to produce seed in view to reproducing the crop.

163. The Chinese sugar-cane will yield 2 or 3 successive cuttings of fodder, under good cultivation when, occasionally watered, but it does not throw out so many fresh stems, as, do the cholums of this country after each cutting.

PLANTERS' FRIEND.

General nature of soil	Sandy loam.
Area of land sown	3,654 square yards.
Cultivation of soil before sowing	Twice ploughed, harrowed, and ridged, and again ridged by splitting the ridges over the manure.
Kind and quantity of manure used	24 cart loads of farm-yard manure.
Pounds of seed sown	10 pounds.
Date of sowing	16th of October.
Date of appearance of plants above ground ...	21st of October.
Cultivation during growth of crop	Once hoed by cattle, and twice hand hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	22 wet days; 19·57 inches.
Date when crop harvested	3rd of February 1876.
Weight of grain when fit for market	992 pounds.
Weight of straw when dry	5,040 pounds.

164. The yield, per acre, was thus 1,313 pounds of grain and, 6,675 pounds of straw.

165. Like the Chinese sugar-cane, the planters' friend is a fodder producer, and therefore, to obtain from it the largest quantity of nutritious fodder, it should be cut down when in flower. In the experiment, under notice, the object was, to obtain seed for distribution.

166. It will be observed that, the planters' friend produced a somewhat smaller return, of straw than did the Sorghum Saccharatum but, it yielded a larger quantity of grain. The crop was produced without the aid of irrigation water.

167. Some years ago I made a small experiment with planters' friend but, the results were not encouraging; the crop, occupied nearly six months in reaching maturity; in the experiment, just referred to the crop was scarcely four months on the ground.

MAIZE.

168. The varieties of maize imported were Early French, Early American, and Yellow Flint. The first, matured about twelve weeks after sowing, but produced very small cobs; this variety is, apparently, not suited for field culture. The other

two varieties grew very well and produced good average crops. The total quantity of seed sown was 46 pounds, and, the quantity of seed harvested was 1,900 pounds. No special experiments were made with the maize.

169. The following are the results of some ordinary sowings in which the maize seed was sown in lines, alternately with lines of cotton seed :—

MAIZE—EARLY AMERICAN.

General nature of soil	Sandy loam.
Area of land sown	2·83 Acres.
Cultivation of soil before sowing	Twice ploughed, harrowed, and ridged and, again ridged over the manure.
Kind and quantity of manure used	42 loads of farm-yard manure.
Pounds of seed sown	18 pounds.
Date of sowing	21st of September.
Cultivation during growth of crop	Twice hand hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	31 wet days ; 24·00 inches.
Date when crop harvested	29th of December.
Number of cobs	7,390.
Weight of straw when dry	5,824 pounds.

170. The foregoing, it must be remembered, is the produce only of half of the ground, the cotton crop occupying the other half.

MAIZE—YELLOW FLINT.

General nature of soil	Sandy loam.
Area of land sown	1½ acres.
Cultivation of soil before sowing	Ploughed, harrowed, and ridged.
Pounds of seed sown	19 pounds.
Date of sowng	22nd of September.
Date of appearance of plants above ground ...	25th of September.
Cultivation during growth of crop	Twice hand hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	31 wet days ; 24·00 inches.
Date when crop harvested	5th of January 1876.
Number of cobs	4,050.

171. The remarks, made with reference to the last experiment regarding the area of land actually cropped, apply equally to this.

PRAIRIE GRASS (*Bromus unioloides*).

172. A small area of land was sown with the seed of this grass, the general results were not more satisfactory than were those we obtained with Prairie Grass seed in former years. The seed germinated well and, produced healthy plants but, these all died down in the hot season. The prairie grass is highly esteemed in Australia, where it is said to thrive in the hottest seasons but, from my experience with it, at Sydapet, I do not think it is suited for the conditions generally met with in this part of India ; besides, it is not a perennial grass, and, we already possess many annual fodder plants that yield heavily, under fair cultivation.

BUFFALO GRASS (*Stenotaphrum glabrum*).

173. A few roots of this grass were obtained from Australia: though they were sent in a box, without any special precautions having been taken in packing, most of them were alive on reaching Madras. As, these roots had been out of the ground for six or seven weeks, at the least, the fact of their surviving this treatment is, I think good evidence of the hardihood of the grass.

Great vitality.

174. The plants have thriven since being planted out and, are spreading over the ground, but the area yet planted is too small, to admit of any practical conclusions being arrived at regarding the suitability of the buffalo grass for general culture here.

175. The buffalo grass is very highly appreciated in Australia and in America. Dr. Schomburgh in a lecture, he recently delivered before an Australian audience, speaking of the buffalo grass said :—

"The buffalo grass (*Stenotaphrum glabrum*), is a native of the warmer countries of America, which I cannot sufficiently recommend. It is a perennial, and every farmer and squatter should not be without some of this valuable grass. It is a creeping grass like the couch or dub grass, and is capable of standing any drought. Its fattening qualities, I think, are not so great as the before mentioned grasses; but the cattle and sheep like it very much. It thrives well on a sandy soil, and is easily propagated from cuttings, as every little piece will grow, and after taking root it spreads very rapidly. It is also well adapted for binding river banks or sandy spots. It can advantageously be used for permanent pastures. The buffalo grass is entitled to a general introduction to our pasture. It is also very suitable for garden lawns. Every one who has visited Sydney no doubt has been struck with the fine lawns, especially those of the Botanic Gardens. Since the last two years I have used it also for this purpose instead of the couch grass. The buffalo grass keeps its verdant freshness winter and summer—a great contrast regarding the dullness of the color which the couch grass has during the winter. Notwithstanding, as already mentioned, that in appearance the buffalo grass seem to be coarse, cattle readily feed on it."

176. In his report for 1868, the Commissioner of Agriculture for the United States, thus refers buffalo grass ;—

"Mr. Harris Lewis exhibited samples of buffalo grass, he had found in Wisconsin which, he considered the most valuable he had seen for grazing. He found it growing over an area of 90,000 square miles."

177. Dr. George Bennett in a paper on Australian grasses published in 1873 says, regarding buffalo grass :—

"My friend, Mr. Charles Moore, has given me some information on the subject, which I will embody with my own observations. It would scarcely be possible to over-estimate the value of the buffalo grass in situations suited for its growth, but although introduced in this colony many years ago, it has not been spread by any means to that extent which its abundant yield and nutritive quality would have led one to expect—arising perhaps from its scarcely ever producing seed, in this colony, and the necessity, therefore, of planting it by offsets or cuttings, I can testify that no grass grown here can equal it, either for weight of herbage or for withstanding drought."

"It will grow on poor soils, in dry exposed situations, or under the shade of trees, where no other grasses will exist; but it is in low sheltered situations that this excellent grass flourishes

to the greatest advantage. When kept close eaten down, the thickly interwoven stems forms such a perfect mat as to overpower and destroy all other similar plants growing near. The cause of fertile seed not being produced in this colony is that this grass is dioecious, and we have only the female plants which, although having seeds in profusion, never attain maturity."

Grown in saline soils.

178. The buffalo grass is said to thrive in hardened alkaline saturated soils on which other grasses will scarcely exist: in this country we have a large area of such soils.

OSAGE ORANGE (*Maclura aurantiaca*).

179. We have raised a number of osage orange seedlings from seed, imported from Australia last year. They are healthy and appear to be thriving. It is hoped that this shrub can be acclimatized in this country as, it is well adapted for forming live fences, being bushy in habit of growth and, armed with long formidable spines.

180. The osage orange is greatly valued as a hedge plant in the Southern States of America and, in some parts of Australia. It is said that, the plant grows rapidly, thickens its branches freely when pruned, is not liable to be attacked by insects nor to be eaten by cattle and, will grow in any soil of ordinary fertility.

CROP STATISTICS.

181. The following statistics, refer to crops grown on the Sydapet Farm last year:—

SUMBA PADDY.

General nature of soil	A stiff loam.
Area of land sown	·88 acres.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	6 cart loads of yerkum and croton plants.
Date of planting	14th October 1875.
Date when harvested	10th February 1876.
Weight of grain when fit for market	Yield of plot 1,200 lbs. Yield, per acre, 1,364 lbs.

SUMBA PADDY.

General nature of soil	A stiff loam.
Area of land sown	·52 acres.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	6 cart loads of yerkum and croton plants.
Date of planting	29th September 1875.
Date when crop harvested	20th January 1876.
Weight of grain when fit for market	Yield of plot 1,127 lbs. Yield, per acre 2,167 lbs.
Weight of straw when dry	Yield of plot 2,128 lbs. Yield, per acre, 4,092 lbs.

SUMBA PADDY.

General nature of soil	A stiff loam.
Area of land sown	·52 acres.
Cultivation of soil before sowing	Ploughed and levelled.

Kind and quantity of manure used	2 cart loads of yerkum and croton plants.
Date of planting	28th September 1875.
Date when harvested	19th January 1876.
Weight of grain when fit for market	Yield of plot 681 lbs. Yield, per acre, 1,310 lbs.
Weight of straw when dry	Yield of plot 1,568 lbs. Yield, per acre, 3,015 lbs.

SUMBA PADDY.

General nature of soil	Stiff loam.
Area of land sown	1 acre.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	8 cart loads of yerkum and croton plants.
Date of planting	21st October 1875.
Cultivation during growth of crop	Hoed.
Date when crop harvested	13th February 1876.
Weight of grain when fit for market	Yield of plot 2,090 lbs. Yield, per acre, 2,090 lbs.
Weight of straw when dry	Yield of plot 2,352 lbs. Yield, per acre, 2,352 lbs.

SUMBA PADDY.

General nature of soil	Stiff loam.
Area of land sown	·23 acres.
Cultivation of soil before sowing	Ploughed and levelled.
Date of planting	24th November 1875.
Date when crop harvested	6th March 1876.
Weight of grain when fit for market	Yield of plot 230 lbs. Yield, per acre, 1,000 lbs.
Weight of straw when dry	Yield of plot 448 lbs. Yield, per acre, 1,948 lbs.

CAR PADDY.

General nature of soil	Stiff loam.
Area of land sown	1,190 square yards.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	8 loads of box manure.
Date of sowing	17th January 1876.
Date of appearance of plants above ground ...	21st January 1876.
Date when crop harvested	18th May 1876.
Weight of straw when dry	Yield of plot 1,436 lbs. Yield, per acre, 5,840 lbs.
Weight of grain when fit for market	Yield of plot 230 lbs. Yield, per acre, 935 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	2 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	60 lbs.

Date of sowing	29th November 1875.
Date of appearance of plants above ground ...	4th December 1875.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days during growth of crop	7 wet days, 2·99 inches.
Date when crop harvested	6th March 1876.
Weight of grain when fit for market	Yield of plot 1,130 lbs. Yield, per acre, 565 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	·62 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Kind and quantity of manure used	6 cart loads of farm-yard manure.
Pounds of seed sown	30 lbs.
Date of sowing	28th March 1876.
Date of appearance of plants above ground ...	31st March 1876.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	8 wet days, 3·87 inches.
Date when crop harvested	10th May to 25th June.
Weight of fodder	Yield of plot 6,240 lbs. Yield, per acre, 10,065 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	2·09 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Date of sowing	1st September 1875.
Date of appearance of plants above ground ...	6th September 1875.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	29 wet days, 25·27 inches.
Date when crop harvested	20th November to 4th December 1875.
Weight of fodder	Yield of plot 9,196 lbs. Yield, per acre, 4,400 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	2,697 square yards.
Cultivation of soil before sowing	Ploughed and harrowed.
Cultivation during growth of crop	Hoed once.
Date when crop harvested	17th September to 16th November 1875.
Weight of fodder	Yield of plot 7,824 lbs. Yield, per acre, 14,041 lbs.

CUMBOO (*Penicillaria Spicatá*).

General nature of soil	Sandy loam.
Area of land sown	1·02 acres.
Cultivation of soil before sowing	Ploughed and harrowed.

Cultivation during growth of crop	Hoed once.
Date when crop harvested	17th September to 16th November 1875.
Weight of fodder	Yield of plot 6,972 lbs. Yield, per acre, 6,835 lbs.

CUMBOO (*Penicillaria Spicata*).

General nature of soil	Sandy loam.
Area of land sown	4·11 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Kind and quantity of manure used	26 cart loads of ashes.
Pounds of seed sown	30 lbs.
Date of sowing	5th August 1875.
Date of appearance of plants above ground ...	10th August 1875.
Cultivation during growth of crop	Hoed and dug.
Number of inches of rainfall and number of wet days recorded during growth of crop.	19 wet days, 12·92 inches.
Date when crop harvested	From 29th September to 14th October 1875.
Weight of fodder	Yield of plot 10,248 lbs. Yield, per acre, 2,493 lbs.

SHAMAY (*Panicum Miliare*).

General nature of soil	Sandy loam.
Area of land sown	3·5 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Kind and quantity of manure used	5,000 lbs. of oil cake.
Pounds of seed sown	20 lbs.
Date of sowing	18th November 1875.
Date of appearance of plants above ground ...	23rd November 1875.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days recorded during growth of crop. ...	11 wet days, 8·12 inches.
Date when crop harvested	10th January 1876.
Weight of fodder	Yield of plot 5,952 lbs. Yield per acre, 1,701 lbs.

HORSE-GRAM (*Dolichos Uniflorus*).

General nature of soil	Sandy.
Area of land sown	6·25 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	157 lbs.
Date of sowing	30th December 1875.
Date of appearance of plants above ground ...	4th January 1876.
Cultivation during growth of crop	Hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop.	7 wet days; 3·76 inches.
Date when crop harvested	From 2nd May to 17th June 1876.
Weight of fodder	Yield of plot 13,148 lbs. Yield, per acre, 2,104 lbs.

HORSE-GRAM (*Dolichos Uniflorus*).

General nature of soil	Sandy.
Area of land sown	5·02 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	136 lbs.
Date of sowing	24th December 1875.
Date of appearance of plants above ground ...	31st December 1875.
Cultivation during growth of crop	Hoed and dug.
Number of inches of rainfall and number of wet days recorded during growth of crop.	1 wet day ; ·81 inches.
Date when crop harvested	1st April to 1st May 1876.
Weight of fodder	Yield of plot 13,848 lbs. Yield, per acre, 2,759 lbs.

HORSE-GRAM (*Dolichos Uniflorus*).

General nature of soil	Sandy.
Area of land sown	1·09 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	15 lbs.
Date of sowing	6th August 1875.
Date of appearance of plants above ground ...	10th August 1875.
Cultivation during growth of crop	Hoed and dug.
Number of inches of rainfall and number of wet days during growth of crop	15 wet days ; 11·14 inches.
Date when crop harvested	22nd September to 7th October 1875.
Weight of fodder	Yield of plot 3,458 lbs. Yield, per acre, 3,172 lbs.

182. Though, the foregoing statistics, possess no scientific value, they are useful, in affording facts regarding the results of ordinary field practice. I have not attempted to show the cost of production or, the profit derived; but, I have given sufficient details, to enable any one interested, to calculate for himself the cost, or, the return, according to the rates prevalent, where he resides. This, I think is better than giving the financial results, for, the prices of agricultural produce and, the rates paid for labor, vary so greatly, in different parts of the Presidency.

183. The statistics, possess no scientific value because, they refer only to the history of the crop under notice and, take no account of the condition of the soil before the crop was sown. The soils, not being in an uniform condition when put under crop, the results cannot, of course, be compared together. This explains why, one crop, to which no manure was applied, produced as good results as another crop that was manured; the soil, to which no manure was given, having been manured, when bearing the previous crop. It is not sufficient to know the produce, obtained from a soil in a season, and, the expenditure in that season; we need also to know something of the previous history of the soil.

IMPLEMENTS AND MACHINES.

CHAIN PUMP.

184. The chain pump, referred to in a previous report as, being unsuited for use in deep wells when, worked by cattle, has been placed in a well in which the water is not far from the surface of the ground, and, has yielded very fair results as, will be seen, from the following :—

Rate Cattle travelled per hour.	Water raised.			Draught.
	Per hour.	Per hour.	Per day of 8 hours.	
Miles.	Cubic feet.	Gallons.	Gallons.	Hundred weight.
2·2819	231·33	1,441·7	11,533·6	1·5
2·5159	424·12	2,704·7	21,637·6	1·75
2·7955	683·31	4,258·4	34,067·2	1·75
3·0682	657·08	4,094·9	32,759·2	2

185. The draught registered, is only approximately correct, the Dynamometer used not showing accurately the fractions of a quarter of a hundred-weight. A pair of cattle were used in working the pump. The speed at which the cattle could be maintained throughout the day is about 2 miles, per hour, but a speed of about 2¾ miles per hour might be kept up, by working the cattle only for half a day at a yoking, that is, those employed in the morning's yoking to be put to other work in the afternoon, and, to be replaced at the lift by a pair of cattle which had been employed in the morning at other work.

DOUBLE MHOTE.

186. This water-lift continues to give good results. Several models of it have been sent to different parts of the Presidency. In Coimbatore Municipality, to which a model was sent, I recently saw 8 of these water-lifts working. Regarding the introduction of these water-lifts into the Coimbatore District, the Collector, in a letter to the Secretary to the Board of Revenue, No. 8, of the 10th of January 1876, para. 6, wrote :

"That interest has been awakened has been proved to me by numerous ryots having come to Coimbatore to inspect the improved water-lift which, I had constructed from a model furnished to me by Mr. Robertson, and, by their having evinced the most practical proof of its advantage, by adopting it."

Other accounts are equally as satisfactory thus, the Nawab of Masulipatam, in a letter of the 13th of June last wrote :

"The model of a "Double Mhote" which you kindly gave me is found very useful here. I have constructed the Mhote in my lands here and its work is going on now. Many of the Zemindars of the district are also desirous of introducing the practice of the Mouble Mhote, and I hope to see soon its usefulness throughout the district."

SINGLE BULLOCK CARTS.

187. When in Coimbatore, I saw some very useful single-bullock carts that belonged to the Municipality; at my request, the President, A Wedderburn, Esq., was good enough to have a specimen cart made up for experimental use on the Sydapet Farm. The cost of the cart at Coimbatore was only Rupees 35.

188. The following draught experiments were made with the Coimbatore cart, an ordinary country cart, and, a large box cart. The respective dead-weights of which were 547 lbs., 609 lbs., and 892 lbs.; the load of each cart was 100 large bricks weighing 650 lbs. The carts were drawn by coolies, in order to ensure regularity of draught; they were drawn over an ordinary road and over some arable land when loaded. Precautions were taken to ensure that the carts contended with similar conditions.

189. The following table shows the results obtained while the carts were being drawn over the road:—

Station where registered.	Coimbatore cart (single bullock). Loaded.	Country cart (pair bullock). Loaded.	Box cart (pair bullock). Loaded.	Remarks.
	Pounds.	Pounds.	Pounds.	
0	84	112	196	Starting point.
1	56	56	56	
2	56	56	56	
3	56	56	56	
4	56	56	56	
5	56	56	56	
6	308	280	420	A drain crosses the road here.
7	168	140	224	
Average ...	103·6	101·5	140	

190. The next table, shows the results obtained, while the carts were being drawn over the arable ground.

Station where registered.	Coimbatore cart (single bullock). Loaded.	Country cart (pair bullock). Loaded.	Box cart (pair bullock). Loaded.	
	Pounds.	Pounds.	Pounds.	
0	224	224	336	Starting point.
1	168	224	224	
2	168	168	224	
3	140	224	252	
4	168	224	224	
5	196	224	252	
6	196	224	224	
7	168	252	224	
8	168	196	252	
9	196	224	252	
10	224	196	224	
Average ...	183·2	216·3	244·3	

SWEEDISH PLOUGHS.

191. Arrangements have been made for procuring from Sweeden a few specimens of the iron ploughs exhibited at the Vienna Exhibition by Sweedish manufacturers. These ploughs were offered at very low prices and, they were referred to, in very favorable terms in the report of the Exhibition Commissioners.

IMPROVED WATER-CART.

192. A very handy water-cart was recently made in the Workshops. It consists of two zinc cans, hung between a pair of wheels. It is drawn by a single bullock. Each can contains 30 gallons; an iron hoop encircles each, at about half its height and, to this, the pivots are attached, by which the can is suspended. Being hung on pivots, the cans, when full of water, are always in an upright position, and the pivot hanging renders it easy to turn the cans over to be emptied. Being hung so close to the ground the cans can readily be filled by a boy.

IMPLEMENT WORKSHOPS.

193. The following implements and tools were supplied by the Workshops during the year to persons living in the provinces and districts mentioned :—

Province or District.	Combined Ploughs.	Iron Ploughs.	Iron Cultivators.	Maize Shellers.	Iron Harrows.	Drag Harrows.	Seed Barrows.	Winnowing Machines.	Scythes, &c.
Assam	...	2	...	1	1	...	...	...	...
N.-W. Provinces	1	...	...	...	...	1	1	...	...
Bombay	...	1	...	...	...	...	...	...	...
Chingleput	...	1	2	1	1	...	...	1	...
Mysore	4	4	1	...	1	1	...	...	...
Vizagapatam	...	...	1	...	1	...	...	...	...
Madras	2	1	...	...	...	...	...	...	...
Various	...	...	...	...	...	...	...	...	35
Total ...	7	9	4	2	4	2	1	1	35

194. In addition, a large quantity of work was done for the Sydapet Farms and, a number of models of water-lifts and implements, were made for distribution free to applicants.

195. The following are the details of income and expenditure during the past year :—

Income.

	RS.	A.	P.
Advance from General Funds	219	4	11
Machines, &c.	1,036	2	6
Labor, materials, &c.	1,103	15	3
Total ...	2,359	6	8

Expenditure.

Plant	23	14	0
Cooly labor, &c.	1,188	10	7
Materials, &c.	1,081	14	1
Interest on Capital	65	0	0
Total ...	2,359	6	8

Implement Workshops' Balance Sheet on the 31st of March 1876.

LIABILITIES.

	RS.	A.	P.
Loan from General Funds for 1870-71	883	1	5
Do. do. 1871-72	213	1	2
Do. do. 1872-73	1,077	3	2
Do. do. 1875-76	219	4	11
Outstanding bills	93	4	0
Laborers' pay due for March 1876	105	2	10
	2,591	1	6

	RS.	A.	P.			
Deduct capital returned by excess of income over expenditure during 1873-74	213	10	5			
Deduct capitul returned by excess of income over expenditure during 1874-75	122	15	9	336	10	2
			Total ...	2,254	7	4

ASSETS.

Buildings	419	15	3
Plant	327	11	6
Materials	147	4	6
New implements, machines, &c , in stock	461	0	0
Outstanding bills	312	1	8
Deficiency	586	6	5
Total ...	2,254	7	4

MODEL FARM.

196. This experiment was brought to a close in March last, our experience, during the past three years, having proved conclusively that, owing to the circumstances under which the experiment was being conducted, no useful information could be gained from it of the kind it was instituted to afford.

197. I have previously pointed out that, originally, the experiment was instituted to ascertain *what results could be obtained under an improved system of farming*, and that, before it had made much progress, it was found impossible to effect any thing of a satisfactory nature by improved tillage, &c., until, some very extensive and costly land improvements had first been carried out from the dilapidated, worn-out condition of the land ; and that as it had been thought undesirable to alter the scope of the experiment, these land improvements, were carried into effect along with, the legitimate work of the experiment.

198. In my last Annual Report, at para. 153, I wrote :

" All things considered, it would perhaps be the fairest way of now dealing with the experiment, to consider the balance against the farm, as expenditure on behalf of the landlord to be dealt with, in the same way as with other expenditure on permanent improvements ; to push on energetically to completion the whole of the contemplated improvements, and, at the end of the present year, if these improvements are then completed and the farm amply supplied with irrigation water, to have the whole of its soils valued by the Settlement Department, the rent, thus fixed, to be the ultimate rent of the farm *without any other charge.*"

However, the land, being needed for the stock-breeding experiment, elsewhere referred to, no other land, so favorably situated or, circumstanced, being available, it was accordingly, added to the Experimental Farm. In this way, a considerable outlay has been avoided. Under any circumstances, this experiment could not have proceeded much further, on its original basis for, a Railway line is to be cut right across the land on which it was being conducted and this would, of course, put a stop to its further progress.

199. Though, I have, repeatedly, in my Annual Reports, noticed the circumstances, under which this experiment begun, I must refer to the matter once more, it is so important, that the facts should be clearly understood;—In the official year 1867-68, the northern half of the Sydapet Farm Estate was rented out under short leases to native tenants; they cultivated only the land fit for ploughing, from the remainder, they obtained a very fluctuating income by collecting and selling, the fruit of the wild guava bushes with which much of the land was covered. In 1870-71 these tenants petitioned the Committee (by whom the Estate was then managed) for permission to relinquish their tenancies. The land, being in an extremely unsatisfactory condition and being a serious nuisance to the neighbouring Experimental Farm, the Committee who, had frequently written off large arrears of rent and had always experienced great difficulty in gathering in any rent, resolved, to take the land into their own management and, to write off all the arrears of rent.

200. The Committee, acting to some extent on my advice, determined to open a Commercial Farm on this abandoned land. At first, it was deemed necessary only, to crop the better soils (about 60 per cent. of the whole area) but, we soon found ourselves compelled to cultivate the whole area, from the rough untidy appearance the uncultivated land gave to the whole. And though, at starting we purposed doing no more in carrying out land improvements than, was absolutely necessary to admit of the soils being tilled, we had no alternative but, to undertake some very extensive and costly improvements.

201. During the first three years of the period over which the experiment extended, the low-lying land near the river, which is, naturally, the best in the whole area yielded satisfactorily; but, during the past two or three years several serious losses resulted from the cultivation of this land, caused by the destruction of several crops, by the River Adyar flooding the ground; while, from the deficiency of irrigation water late in the season, the re-sowings on this land seldom produced crops that reached maturity.

202. In the earlier stages of the experiment, the sandy soils appeared to be improving under cultivation; but, the extraordinary rainfall of 1872-73 showed that, but little permanent good could be effected towards the improvement of these soils until, they *were protected from the washing influences of flowing water* during heavy rain. At first, I was reluctant to incur the heavy expense that would result, from attempting to stop the wash, by levelling and terracing these sandy soils but, eventually I began the work seeing that, on these soils, all the benefits from good tillage and the application of manure were lost, whenever the rainfall was unusually heavy. Some of these soils, contained as much as 95 per cent. of

sand and, the land being undulating, it will readily be understood that, with a rainfall, sometimes, as much as 5 inches in a day, the loss, of soluble and portable manure, could not but be enormous. As, I have elsewhere mentioned, the land that has been levelled and terraced has improved very greatly.

203. There are many other reasons why this experiment was not attended with more satisfactory results; but, I have noticed these, so fully, in previous Annual Reports, it seems unnecessary again to detail them.

204. It will readily be understood, from what I have mentioned that, the site was altogether an unsuitable one for the purposes of a Commercial Farm; but the more serious objections did not disclose themselves until, the experiment had made some progress. Had it been possible, to have conducted the experiment, as was originally intended, without undertaking any costly land improvements, the expenditure would, of course, have been very much smaller. Though the money return was not so large as, could have been desired, the general result of the undertaking cannot be said to be unsatisfactory for, I believe, that *the land could now be sold for a price that, would represent its original cost with the whole of the net outlay added.*

205. The following statement, exhibits the income and expenditure of the farm during the past year :—

Expenditure.

	RS.	A.	P.
Rent and interest (½ year)	512	12	9
Overseer's salary	730	0	0
Labor	1,305	4	1
Cattle	0	0	0
Pigs	83	9	0
Sheep	85	0	7
Poultry	119	11	6
Implements, machines, and tools	295	13	0
Seeds	181	15	11
Cattle food	604	10	9
Manure	259	1	6
Sundries	28	5	3
Total ...	4,206	4	4

Income.

Advance from General Funds	2,436	11	0
Cattle	10	12	0
Pigs	74	7	6
Sheep	273	15	2
Poultry, &c.	138	5	6
Fruits, plantain, and vegetables	448	14	1
Grains, fodder, &c.	527	6	9
Indigo, cotton and sundries	295	12	4
Total ...	4,206	4	4

206. The statements that follow show the expenditure on behalf of the experiment, and the income derived from it :—

Expenditure from the commencement of the Farm up to and including the 31st of March 1876.

Items.	1870-71.*			1871-72.			1872-73.			1873-74.			1874-75.			1875-76.			Total.					
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cooly labor	1,105	4	2	1,375	9	11	1,369	14	0	1,317	1	11	1,589	12	4	1,475	8	11	8,233	3	3			
Manure	†3	0	0	†71	1	4	†185	2	7	†41	7	7	462	6	0	259	1	6	1,022	3	0			
Live-stock	1,641	15	0	731	6	8	636	3	0	252	10	3	333	13	4	288	5	1	3,884	5	4			
Food for live-stock	267	11	9	557	7	3	506	3	11	531	15	1	537	13	2	604	10	9	3,005	13	11			
Seeds, trees, &c.	194	1	7	91	6	7	153	9	2	122	13	5	182	10	1	181	15	11	926	8	9			
Implements, tools, &c.	461	9	0	18	13	0	277	8	6	67	5	0	334	1	4	295	13	0	1,455	1	10			
Contingencies	74	4	9	100	2	3	16	6	9	16	10	2	56	3	7	28	5	3	292	0	9			
																						18,819	4	10
Overseer's salary	113	12	0	370	0	0	600	0	0	610	0	0	647	8	0	730	0	0	3,071	4	0			
Rent	192	8	0	385	0	0	385	0	0	385	0	0	385	0	0	385	0	0	2,117	8	0			
Interest on capital employed in working the Farm	69	8	4	150	0	0	200	0	0	200	0	0	200	0	0	200	0	0	1,019	8	4			
Interest on capital expended on improvements of a permanent character	94	6	7	296	1	8	328	1	6	328	1	6	328	1	6	440	9	6	1,815	6	3			
																						8,023	10	7
																			Total ...			26,842	15	5

* Half year.

† In these years a number of cattle were fattened, and therefore more manure was made at the Farm.

Income from the commencement of the Farm up to and including the 31st of March 1876.

Items.	*1870-71.			1871-72.			1872-73.			1873-74.			1874-75.			1875-76.			Total.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cattle	403	1	9	560	14	9	371	15	0	419	7	5	85	0	0	10	12	0	1,851	2	11
Sheep	...	...	...	141	10	6	237	2	6	188	10	9	132	3	5	273	15	2	973	10	4
Pigs	...	...	...	263	14	0	664	5	9	390	11	6	344	0	11	74	7	6	1,737	7	8
Poultry, &c.	12	6	0	97	8	0	203	4	0	65	2	10	84	1	0	138	5	6	600	11	4
Fruits, vegetables, &c.	474	12	6	582	10	3	444	1	6	290	1	11	568	2	11	448	14	1	2,808	11	2
Hay, green fodder, &c.	42	8	0	256	6	0	484	13	6	238	11	3	150	1	10	196	5	5	1,368	14	0
Grains	407	0	10	705	9	3	178	11	2	411	5	7	258	1	9	331	1	4	2,291	13	11
Indigo and cotton	...	...	...	...	...	...	...	...	...	232	12	6	7	8	0	87	14	8	328	3	2
Sundries	101	10	3	228	4	0	301	9	10	113	3	6	345	7	10	207	13	8	1,298	1	1
Total ...	1,441	7	4	2,836	12	9	2,885	15	3	2,350	3	3	1,974	11	8	1,769	9	4	13,258	11	7
Add the valuation of the assets on the 31st of March 1876																			7,663	5	1
Total ...																			20,922	0	8

* Half year.

207. The next statement, exhibits the balance sheet of the year, excluding the additional value given to the property, by the improvements effected :—

Liabilities.

	RS.	A.	P.
Loan from General Funds for 1870-71	2,776	9	10
Do. do. 1871-72	1,310	3	11
Do. do. 1872-73	1,772	2	2
Do. do. 1873-74	1,522	13	8
Do. do. 1874-75	3,082	9	8
Do. do. 1875-76	2,436	11	0
Laborers' pay due for March 1876	170	4	10
Half year's rent and interest not charged	512	12	9
Total ...	13,584	3	10

ASSETS.

Cattle.

	RS.	A.	P.	RS.	A.	P.
13 working cattle	800	0	0			

Sheep.

52 ewes, 2 wethers, 3 lambs	200	0	0			
Pigs	80	0	0			
Poultry	173	8	0			
				1,253	8	0

Implements.

Implements, tools, carts, &c., as catalogued				1,114	4	0

Manures.

Manure of sorts	25	0	0			
¼ cost of manure purchased in 1874-75	115	9	6			
¼ cost of cake purchased in 1874-75	134	7	3			
¼ cost of manure purchased in 1875-76	129	8	9			
¼ cost of cake purchased in 1875-76	302	5	5			
				706	14	11

Fruit and Fuel Trees, &c.

Cocoanut trees, mango trees, and casuarina trees. Guava trees and cashew-nut trees				3,000	0	0
Young trees in Nursery				130	0	0
Fruit crops				325	0	0

Field Crops.

Grain and pulse crops ... ... Guinea-grass ... ... Fodder crops of sorts				350	0	0
Dry fodder				40	0	0
Cultivation done for next year				75	0	0

Uncollected Bills.

Due by sundry persons	46	14	2			
Cattle labor performed in 1873-74, 1874-75, and 1875-76 in Estate improvements	621	12	0	668	10	2
Difference, being balance against the Farm				5,920	14	9
Total ...				13,584	3	10

208. In the following statement, the final result of the experiment, is shown :—

Cost of the land ;—

	RS.	A.	P.	RS.	A.	P.
20 acres, at 53 Rupees	1,060	0	0			
91 acres, at 26 do.	2,366	0	0			
				3,426	0	0
Cost of buildings, roads, &c.				6,000	0	0
Balance to debit, shown in the Farm balance sheet				5,920	14	9
				15,346	14	9
Total cost, per acre				138	4	2
Probable selling price, per acre				140	0	0

209. Everywhere, the restoration of exhausted land is one of the most difficult of agricultural problems. A writer, in Fraser's Magazine of August last in referring to Irish Agricultural improvements says :—

" . . . . . My own case is an illustration. I borrowed £1,000 from Government during the famine. I have spent £25,000 on land improvements ; a steady outlay of 800 to 1,000 £ per annum for over 30 years on 4,000 acres. Yet I have not nearly done what is needed. It is only when any one comes practically to improve an estate in the backward condition so many Irish estates are in, that he knows what the work is. Everything has to be done. . . . . Land exhausted as much of the dry land is, needs years of outlay in manure to recover any moderate fertility as all practical farmers know."

210. If I had such an experiment again to direct, I would certainly insist upon fair agricultural land being selected and if, any land improvements were necessary would require that the whole of them likely to interfere with the cropping of the land should be finished before the regular agricultural work began. There is perhaps in cultivation, in this Presidency, no tract of land containing soils of such a low order as those that constitute so large an area of the land on which the experiment was conducted.

ESTABLISHMENT.

211. During the past year Mr. Benson had charge of the Sydapet Farms and Mr. Schiffmayer had charge of the works of permanent improvement carried out on the Sydapét Estate ; Mr. Schiffmayer was also engaged in conducting "laboratory experiments" until an unfortunate accident put a stop to his work in the laboratory. I have much pleasure in acknowledging the valuable aid afforded me by both gentlemen.

212. The Overseers and Clerks have given satisfaction in the performance of their respective duties. Clerk T. Vencatasawmy Naiker accompanied me during my tour in the Coimbatore District; and, by the tact and intelligence he displayed in performing the duty I entrusted to him, aided me, very materially

SYDAPET,
January 1877.

W. R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

APPENDICES.

Expenditure on account of the Madras Agricultural Department.

	RS.	A.	P.	RS.	A.	P.
I. *General Supervision.*						
Establishment	17,929	14	5			
Travelling allowances	372	0	0			
Contingencies	370	9	3			
				18,672	7	8
II. *Madras Experimental Farm.*						
Establishment	1,054	0	0			
Cooly labor	2,908	6	5			
Implements and Machines	744	0	4			
Live stock	785	1	1			
Seeds	796	7	3			
Food for Live-stock	1,691	12	11			
Manure	477	9	3			
Despatching seeds	240	15	9			
Contingencies	220	15	4			
				8,919	4	4
III. *Madras Model Farm.*						
Establishment	730	0	0			
Cooly labor	1,305	4	1			
Manure	259	1	6			
Live stock	288	5	1			
Food for live stock	604	10	9			
Seeds	181	15	11			
Implements, carts, and water-lifts	295	13	0			
Rent and interest	512	12	9			
Contingencies	28	5	3			
				4,206	4	4
IV. *Implement Workshops.*						
Carpenters, smiths, and filer	955	5	9			
Cooly labor	233	4	10			
Machines, implements, and materials	1,170	12	1			
				2,359	6	8
V. *Educational.*						
District Farm Apprentices	525	12	11			
Sydapet do.	1,452	8	0			
Schoolmaster for laborers' children	34	12	0			
Books, &c., for library	201	15	9			
Contingencies	139	11	1			
				2,354	11	9
VI. *Estate Improvements of a Permanent Character.*						
Repairs to buildings, &c.	1,264	9	3			
Construction of field roads and repairs to similar roads ...	210	4	3			
Water channels	173	12	0			
Deepening wells	189	7	6			
Trees and planting	125	13	7			
Levelling and reclaiming land	75	0	0			
Carried forward ...	2,038	14	7	36,512	2	9

* Includes the salary of the Assistant to be placed in charge of the Coimbatore District Farm.

	RS.	A.	P.	RS.	A.	P.
Brought forward ...	2,038	14	7	36,512	2	9
Levelling land to be brought under wet cultivation	325	8	6			
Contingencies	92	11	7			
Building a sheep house	249	4	4			
Manufacture of drain pipes	731	8	1			
Extension of the Implement Workshops	222	9	3			
Brick and mortar bridges under main roads	179	10	1			
Removal and reconstruction of Engine Sheds	314	0	0			
Re-thatching Cattle-sheds at the Experimental Farm	204	1	8			
Building drying sheds for tile yards	238	7	4			
Assistant Superintendent's bungalow	4,431	10	7			
Compensation to Wudders	900	0	0	9,928	6	0
VII. *Other charges and transfers.*						
Inspector of Cattle-diseases	6,698	3	1			
Amount transferred to Local Funds under G.O., 16th October 1875, No. 2,049	50,000	0	0			
Paid Public Works Workshops by transfer	51	1	7			
Expenditure during 1874-75 brought to account in 1875-76 ...	3,532	15	4	60,282	4	0
Total ...				1,06,722	12	9

INCOME OF THE MADRAS AGRICULTURAL DEPARTMENT.

Adjusted balance at the beginning of the year	2,21,133	11	9			
Special Grant	20,000	0	0			
Receipts from the Surplus Pound Fund during 1875-76 ...	66,945	0	5	3,08,078	12	2
Madras Experimental Farm	4,078	14	0			
Madras Model Farm	1,769	9	4			
Implement Workshops	2,140	1	9	7,988	9	1
Total ...				3,16,067	5	3
Balance in favor of the Madras Agricultural Department on the 1st of April 1876	2,09,344	8	6			

VALUATION of Live and Dead Stock belonging to the Sydapet Experimental Farm on the 31st of March 1876.

	RS.	A.	P.	RS.	A.	P.
Cattle—						
5 Bulls						
16 Bullocks	...	...	...	1,400	0	0
1 Cow						
3 Calves						
Sheep—						
44 Rams						
71 Ewes	...	...	...	900	0	0
4 Gimmers						
70 Lambs						
Carried forward ...				2,300	0	0

	RS.	A.	P.	RS.	A.	P.
Brought forward ...				2,300	0	0
Pigs—						
3 Boars ... ... }	...	...	...	250	0	0
5 Sows ... ... }						
Poultry	...	...	...	275	0	0
Manures.						
Manure of sorts	...	...	...	130	0	0
Growing Crops.						
Cotton	120	0	0			
Guinea-grass ... ... }	125	0	0			
Paddy ... ... }						
Gram, and yellow cholum...	25	0	0			
Plantains and brinjals	350	0	0			
Fruit trees	3,200	0	0			
Casuarina and cocoanut trees	350	0	0			
				4,170	0	0
Farm Seeds, &c.						
4,121 pounds of Sumba paddy	82	6	9			
66 „ of Carolina paddy	2	3	2			
410 „ of Car paddy	6	13	4			
562 „ of Tenney seed	23	6	8			
347 „ of Cumboo	17	5	7			
16 „ of Green-gram	0	11	8			
1,078 „ of Sorghum Saccharatum	53	14	5			
272 „ of Yellow cholum	6	12	10			
357 „ of Wheat	17	13	7			
367 „ of Corakapilly seed	18	5	7			
373 „ of Cotton seed	6	3	6			
185 „ of Jute seed	11	1	3			
2½ „ of Poppy seed	0	5	0			
6 „ of Mustard seed	1	2	0			
54½ „ of Sun-flower seed	2	12	4			
64 „ of Roselle seed	5	5	4			
149 „ of Gingelly seed	6	15	9			
17 „ of Linseed	4	9	7			
514 „ of Castor-oil seed	21	6	8			
83 „ of Dew gram	4	9	1			
12 „ of Fenugreek seed	0	12	0			
85 „ of Bengal gram	5	1	7			
11 „ of Sunn seed	1	0	0			
445 „ of Black-gram	22	4	0			
925 „ of Planter's Friend	46	4	0			
204 „ of Pigeon peas	4	4	0			
314 „ of Cotton in seed	26	2	8			
382 „ of Wool	35	13	0			
147 „ of Cotton	29	6	5			
11,891 Maize cobs	118	14	7			
				584	2	4
Carried forward ...				7,709	2	4

	RS.	A.	P.
Brought forward ...	7,709	2	4
Cattle Food.			
9,227 pounds of Ground-nut oil cake	126	13	11
Implements.			
Implements and tools as catalogued in Inventory	4,833	2	0
Total ...	12,669	2	3

Seeds supplied gratis during 1875-76.

Date.	To whom supplied.	Maize.	Cotton.	Carolina Paddy.	Sorghum Saccharatum.
		lbs.	lbs.	lbs.	lbs.
1st May 1875 ...	Chellappa Pillai	...	30	...	...
2nd June ...	The Secretary, Native Association, Mayaveram ...	3	55	100	10
17th July ...	Captain Nicholas	30	...	...	...
21st " ...	A. Ruzsock Sahib, Veerapoor	...	15	10	...
27th " ...	Shaik Abdool Rahiman Sahib	2	12½	15	...
1st Sept. ...	Nuzmodien Sahib, Sydapet	...	10	20	...
27th " ...	Mr. Seshyengar, N. W. Provinces	...	15	20	...
13th Oct. ...	Collector of Kistna	...	10	...	...
" ...	H. Nash, Esq., Salem	...	15	...	...
13th Nov. ...	Collector of Kistna	...	...	50	...
4th Feb. 1876.	Ramachendrarajoo, Vizianagram	10	10	...	10
11th " ...	Monegar of Goodalore, Coimbatore	10	...	...	10
23rd " ...	Collector of Coimbatore	50	...	...	25
28th " ...	Colonel Ashburner	...	...	25	...
" ...	Commissioner of Nilgiris	150	...	...	...
1st March ...	Ragoonada Row, Esq., Travancore	20	20	...	...
" ...	Collector of Madras	150	...	...	...
8th " ...	Deputy Collector of Madras	100	...	...	...
14th " ...	Collector of Vizagapatam	110	...	...	...
21st " ..	J. Fraser, Esq, N. W. Provinces	...	...	10	...
	Total ...	635	192½	250	55

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st of April 1876.

1 Chaff-cutter and universal mill, with bullock power, by Messrs. Ransomes and Sims.
1 Threshing machine, by Dray Taylor & Co.
1 Threshing machine with bullock gear and carriage, by Ransomes and Sims.
1 Winnowing machine, by Dray Taylor & Co.
1 Winnowing machine, by Ransomes and Sims.
1 Winnowing machine, by Hornsby and Sons.
3 Reaping machines, by Samuelson & Co.
1 Cylindrical corn screen, by Ransomes and Sims.
2 Drill sowing machines, 13 rows, by Garret & Co.
3 Bullock hoes.
2 Ploughs, by Ames & Co., Boston.
1 Turn-wrest plough and yoke, by Ransomes and Sims.
1 Bullock plough, by School of Arts.
1 Bullock plough, by Mint.
2 Bullock ploughs, by Ransomes and Sims.
1 Double mould board plough.
1 Large plough, with 2 wheels, by Ransomes and Sims.

1 Swing plough, by Roorkee Workshop.
2 Wet land ploughs, by Experimental Farm.
1 Two-wheel plough, with cultivator by Ransomes & Sims.
1 Sub-soil plough.
3 Country ploughs of different pattern.
1 Country plough from Napier Foundry.
1 Wooden roller.
1 Four-wheel waggon.
1 Stone trolley.
1 Root-pulper, by Ransomes and Sims.
1 Stone roller.
2 Sets of iron harrows with swingletree, by Ransomes and Sims.
1 Wood drag harrow, by Experimental Farm.
1 Iron chain harrow.
3 Country carts.
2 Water carts.
1 Sewage cart, by Gun Carriage Works.
2 Single bullock carts.
1 Overhead, bullock power, with shafts and gearing.
4 English carts.
1 Maize sheller, by Ransomes and Sims.
1 Barrow drill, by Experimental Farm.
1 Water elevator, by Burges and Keys.
1 Water elevator, by Mint.
2 Water elevators, by Experimental Farm.
3 English ladders.
1 Norton's tube well with a rotary motion.
1 English grindstone.
1 Farm bell.
2 Wheel hand-hoes.
2 Dutch hoes.
8 Hoes.
9 Cattle yokes.
1 Archmedian pump.
1 Cake-crusher.
1 Pump, by Roorkee Workshop.
1 Chain pump, by manual power.
1 Chain pump, by bullock power.
1 Combined mill and oil-cake breaker, by Ransomes & Sims.
1 Large platform weighing machine.
1 Large beam and scales.
1 Cotton gin, by Gordon & Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
2 Cotton gins, by Burges and Key.
1 Country cotton gin.
1 Malabar spoon bale.
2 Waterproof cart covers.
1 Sack-barrow.
6 Picottah buckets.
4 Leather buckets with ropes and gearing for double mhote.
1 Large wheel barrow
11 Wheel barrows.
3 Hay frames for carts.
1 Hand cart.
2 Clocks.
9 Tables.
10 Chairs.
2 Writing desks.
1 Almirah.
3 Book cases.
1 Dynanometer.
1 Surveying level with stand staves, &c.
12 Feeding tubs.
4 Metal feeding troughs.
7 Wooden troughs.
1 Manure drag.
2 Bengal picks.
2 Hatchets.
2 Hand barrows.
5 Iron rakes.
30 Mamoties.
1 Large field rake.
9 Crowbars.
18 Picks.
2 Mattocks.
3 Forks of sorts.
1 Iron cash chest.
3 Shovels.
1 Bill hook.
1 Iron reel.
11 Grass knives.
4 Manure forks.
14 Digging forks.
4 Sets of bullock harness.
2 Surveying chains with pins
2 Iron cisterns.
88 Specimen seed bottles.
2 Hedge knives.
3 Pairs of thorn pincers.
1 Ear punch for marking sheep
1 Mercal, one half-mercal, and one measure.
2 Weeding spuds.
3 Pairs of sheep shears.
1 Dibble.
9 Spanners.
5 Mallets.
3 Rammers.
2 Hedge shears.
1 Poultry feeding cage.
2 Maize cob-stands.
8 Fork hoes.
2 Driving wheels.

1 Large rubbish screen.
1 Drain scoop.
1 Lactometer.
1 Single barrel fowling piece.
1 Pair of pan scales.
1 Branding iron for marking sheep.
2 Sickles.
1 Chester measure metallic tape, 66 feet.
9 Levelling boards.
2 Screw jacks.
1 Hoe fork.
1 Hand screen.
2 Cross staves.
3 Iron cots.
3 Benches.
4 Large hand hoes.
1 Small hand hoe.
1 Knife.
4 Reaping knives.
1 Country reaping knife.
1 Lantern.
1 Reading lamp.
1 Pruning knife.
1 Rabbit box.
5 Crates.
1 Sledge hammer.
1 Watering can.
1 Heavy stone cart.
2 Steel stone chisels.
1 Cast iron plough.
1 Steel plough.
1 Maize sheller.
1 Drain-pipe making machine.
2 Draining spades.
1 Set of bottle levels; chemical apparatus, mortars, pestles, glass beakers, &c.
1 Screening die, two pipe dies, 1 hollow brick die, 8 brick moulds, 1 rake for furnace, and 1 poker.
1 Plum level.
1 Table.
1 Set of toddy-drawing tools.
Funnel stands.
1 Almirah.
2 Ladders.

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1st of April 1876.

3 Iron ploughs.
4 Combined ploughs.
1 Set of iron harrows with swingletree.
1 Set chain harrows.
1 Winnowing machine.
1 Drill sowing machine.
1 Grubber.
1 Drag harrow.
2 Country carts.
1 Box cart.
5 Reaping hooks.
8 Picottah buckets.
1 Chopper.
20 Feeding tubs.
1 Spade.
3 Small wheel-barrows.
6 Digging forks.
9 Yokes.
11 Planter's hoes.
1 Tub for well.
1 Scythe.
1 Measure.
1 Half-mercal.
1 Scale, triangle, weights, &c.
1 Large beam and cattle-weighing scale.
10 Fifty-six pound weights.
1 Table.
1 Hay fork.
6 Mamotties.
1 Pair pincers.
1 Turn screw.
1 Chisel.
1 Water cask.
1 Hand saw.
1 Hatchet.
1 Cold chisel.
1 Chaff cutter.
1 Lantern.
1 Steel.
1 Levelling board.
1 Rake.
3 Picks.
1 Meat saw.
1 Hedge knife.
4 Spanners.
1 Crowbar.
1 Mallet.

List of Tools, &c., belonging to the Implement Workshops on the 1st of April 1876.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
20 Tongs.
3 Bellows.
1 Screw plate.
4 Sledge hammers.
8 Small hammers.
6 Smith's chisels.
8 Punches.
1 Countersinking punch.
6 Dies or flat chisels.
2 Pairs of calipers.
1 Iron square.
1 Round file.
1 Half-round file.
1 Flat file.
29 Taps for screw plates.
1 Iron brace and 6 bits.
1 Filer's hammer.
1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
2 Square files.
1 Bob drill.
2 Screw levers.
1 Bench with 2 vices.
3 Hand saws.
1 Cross-cut saw.
1 Pit saw.
1 Auger.
2 Jack planes.
1 Spoke shove.
1 Spirit level.
1 Shoeing rasp.
1 Pincer.
1 Compass.
5 Carpenter's chisels.
2 Set squares.
1 Angle square.
3 Gimlets.
1 Brace with 34 bits.
2 Adzes.
2 Turn screws.
1 Plummet.
4 Saw files.
1 Rasp for wood.
2 Mallets.
1 Pair scales.
1 Cold chisel.
2 Chisels.

Furniture, &c., belonging to the Office of the Superintendent of Government Farms on the 1st April 1876.

4 Almirahs.
5 Tables.
7 Chairs.
1 Iron cash-chest.
1 Eight-day American time-piece.
1 Rain gauge.
1 Portable scale with weights.
1 Letter scale with tolah and ounce weights.
2 Ivory thermometers.
1 Aneroid barometer.
1 Do. compass.
1 Office folding-table.

List of Books added to the Government Farms' Library during 1875-76

Veterinary Medicines, their actions and uses, by Finlay Dun, 1874.
Flora Indica, or Descriptions of Indian Plants, by W. Roxburgh, M.D., 1874.
Chemistry, by H. E. Roscoe, 1874.
Physical Geography, by Archibald Geikie, L.L.D., &c., 1874.
Geology, by Archibald Geikie, L.L.D., &c., 1874.
Report on the Irrigation of Eastern Spain, by Clements R. Markham.
Text Book on Estimating, by James Schoury, 1872.
A Manual of Family Medicine for India, by W. J. Moore, 1874.
Suggestions in regard to Sanitary Works required for improving Indian Stations, 1869.
Rudimentary Treatise on Mineralogy, by D'Varley, 1859.
A Treatise on Mathematical Instruments, by J. F. Heather, M.A., 1849.
Rudimentary Treatise on the Drainage of Towns and Buildings, by G. D. Dempsey, C.E., 1854.
Rudiments of the Art of Building, by E. Dobson, C.E., 1854.
Rudimentary Treatise of the Principles of Design in Agriculture, by E. L. Garbett, 1840.
Rudimentary Architecture for the use of Beginners and Students, 1844.

Rudimentary Mechanics for the use of Beginners, by Charles Tomlinson, Vol. 6, 1859.
Pneumatics for the use of Beginners, by C. Tomlinson, Vol. 12, 1858-59.
Elements of Mechanics, by T. Baker, C.E., 1852.
Rudimentary Treatise on the Drainage of Districts and Lands, by G. D. Dempsey, C.E., 1859.
Rules and Formulæ for the computation and solution of the various Hydraulic Problems, &c., by Major J. F. Stoddard, 1866.
School Botany and Vegetable Physiology, by John Lindley, PH.D., 1858.
Medical and Æconomical Botany, by John Lindley, PH.D., 1859.
Rudiments of Hydraulic Engineering, by G. R. Burnell.
Rudimentary Treatise on the Drainage of Districts and Lands, by G. D. Dempsey, 1859.
A Treatise on Water Works, by Samuel Hughes, F.G.S., 1859.
Catechism of Agricultural Chemistry, by W. B. Tegetmeier.
The Works of Martin Doyle, 2 Vols., 1836.
The Daily Life of our Farm, by the Rev. W. Hott-Beever, M.A., 1871.
The Cattle, by W. C. L. Martin and W. H. Raynbird, 1862.
The Sheep, by W. C. L. Martin, 1862.
The Pig, by H. D. Richardson.
The Sketches of Rural Affairs, the Plough and Sickle, 2 Vols., 1845.
Manual of Gardening, by R. Riddell.
Rudiments of Geology, by David Page, 1854.
British Husbandry, by C. W. Johnson, F.R.S., 3 Vols., 1848.
Materia Medica of Hindoostan, by Anslie, 1813.
European Agriculture and Rural Economy, by Henry Coleman, Vol. I, 1846.
Popular Botany, by James Main, A.L.S., 1835.
Timber Trees.
Profitable Fowls and Eggs.
Journal of the Royal Agricultural Society of England, 2nd Series, Vol. XI, Part I, No. XXI, 1875.
Do. do. do. Part II, No. XXII, 1875.
Third Reader, describing the Products of Southern India, 1869.
First Mnemonical Lessons in Geometry, Algebra, and Trigonometry, by Rev. Thomas Penington Kirkman, M.A., 1852.
Rudimentary Treatise on Foundations and Concrete Works, by E. Dobson, C.E., 1850.
Rudimentary Treatise on the Power of Water, by Joseph Glynn, F.R.S., &c., 1853.
The Gardener, by Houlston and Wright.
The Shepherd, by Houlston and Wright.
How to make Money by Horses, by Harry Hiebver, 1862.
Stockhardt's Agricultural Chemistry, by Arthur Henfrey, F.R.S., F.L.S., 1855.
Views of Nature or Contemplations on the Sublime Phenomena of Creation with Scientific Illustrations, by A. VonHumboldt, translated by the German by E. C. Otte and Henry G. Bohn, 1850.
Rudimentary Dictionary of Terms used in Agriculture, Civil, Architecture, Naval, Building, and Construction, Early and Ecclesiastical Art, Engineering, Civil Engineering, Mechanical, Fine Art, Mining, Surveying, &c., by John Weale, 1849-50.
Rudimentary Treatise on the Blasting and Quarrying of Stone for Building and other purposes, by Major-General Sir John Burgoyne, K.C.B., &c., 1849.
Introduction to the Study of Natural Philosophy, for the use of Beginners, by Charles Tomlinson, 1848.
Rudimentary Treatise on Limes, Cements, Mortars, Concretes, Mastics, Plastering, &c., by George R. Burnell, C.E., &c., 1856.
Rudimentary Treatise on Geology, for the use of Beginners, by Lieutenant-Colonel Portlock, R.E., F.R.S., F.G.S, &c., 1854.
Pneumatics, for the use of Beginners, by Charles Tomlinson, 1858-59.
Rudimentary Chemistry, for the use of Beginners, by Professor Fowns, F.R.S., 1854.
Rudimentary Art of Constructing and Repairing Roads, by Henry Law, C.E., 1855.
Rudimentary Treatise on Blasting and Quarrying of Stone, by Major-General Sir J. Burgoyne, K.C.B., &c., 1849.

Rudimentary and Practical Treatise on Perspective, &c., by George Pyne, 1852.
The Storage of Water, by J. Bailey Denton, M.INST.C.E., F.G.S., 1874.
A Gaeztteer of the Territories under the Government of East India Company and of the Native States on the Continent of India, by Edward Thornston, Esq., 1857.
Trigonometrical Survey of Mysore, Malabar, &c.
Animal Physiology, by William B. Carpenter M.D., F.R.S., F.G.S., 1851.
Cattle; their Breeds, Management, and Diseases, 1834.
Sheep; their Breeds, Management, and Diseases, 1841.
Treatise on Sheep, by Ambrose Blacklock, 1840.
The Pig, by William Youatt, V. S., enlarged and re-written by Samuel Sidney, 1860.
Fish Culture, by Francis, 1863.
Synopsis of the Species of the Class Mammalia, by Cuvier.
The search for Nitre and the true Nature of Guano, by T. E. Eden, 1846.
General Outline of the Organization of the Animal Kingdom and Manual of Comparative Anatomy, by Thomas Rymer Jones, F.R.S., 1855.
The Agricultural Instructor, by Edmund Murphy, A.B.
A Sketch of the Principal Families of Plants, by Arthur Henfrey, F.R.S., 1855.
Vegetable Physiology and Systematic Botany, by William B. Carpenter, M.D., F.R.S., F.G.S., 1850.
Italian Irrigation, by R. Baird Smith, F.G.S., 1852.
The useful Arts employed in the Production of Food, 1850.
The Nature and Properties of the Sugar-cane with Practical Directions for the Improvement of its Culture and the Manufacture of its Products, by George Richardson Porter, 1831.
The Culture and Commerce of Cotton in India, by Forbes Royle, M.D., F.R.S., 1851.
A short account of the Modes of Sewage Disposal in some of the chief towns of England, 1860.
Descriptive Botany, or the art of describing Plants correctly in scientific language, by Professor Lindley, F.R.S., 1874.
A Manual of the District of Cuddapah, by J. D. B. Gribble, M.C.S., 1875.
A Manual of Indian Cattle and Sheep, by Dr. John Shortt, 1876.
Bamboo considered as a Paper-making material, by Thomas Routledge, 1875.
Report on the preparation and use of Rhea Fibre, by J. Forbes Watson, M.A., &c., 1875.
Gums and Gum Resins, by Edwin T. Atkinson, B.A., Part I, 1876.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY),

FOR THE YEAR ENDING 31ST MARCH 1877.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT PRESS, FORT ST. GEORGE.
1877.

CONTENTS.

	Pages
Introductory	1 to 2
Sydapet Experimental Farm—	
General	3 to 7
Cultivation and Crops	7 to 14
Special Crops	14 to 16
Hedge Plants	16
Manures	17 to 18
Live-stock	18 to 22
Foods and Feeding	22
Foods	23
Implements, Machines and Tools	24 to 26
Distribution of Seeds	27
Implement Workshops	27 to 28
Estate	28
Permanent Improvements	29
Agricultural College	30 to 48
The Carolina Paddy Experiments—	
Introductory	49 to 50
The soils, and their preparation for the crop	50 to 52
The seed, seedlings and the method of sowing and planting	52 to 53
Irrigation and culture of the crop	53 to 54
Observations made during the growth of the crop and at harvest	54 to 55
The Produce	55 to 71
General opinions and observations regarding the crop	71 to 80
General conclusions	80 to 84
Notes on Carolina Paddy in America—	
History and Peculiarities of the Crop	85 to 86
Land usually cropped with Paddy and method of preparing it for cropping	86
Cultivation of the Crop	87 to 88
Harvesting	88
Preparation for the Market	88 to 89
Correspondence, Finances, Establishment, &c.	92 to 93
The growth of Forage for Live-stock with some remarks on our fodder plants	94 to 97
The pernicious effects of the use of cattle-dung as fuel	98 to 102
The physical properties of the soil as influenced by tillage and the application of organic manure	103 to 110
Some manural substances yet unutilized in this country	111 to 120

APPENDICES.

	Pages
Appendices to the Sydapet Experimental Farm Report—	
Receipts of the Sydapet Experimental Farm	125
Valuation of the Sydapet Experimental Farm Estate, Buildings and of the Live and Dead Stock of the Farm	*ib.*
Appendices to the Agricultural College Report—	
Examination Regulations	129
Examination Question Papers of the Winter Session	*ib.*
Attendance Marks Regulations	134
Examination and Full Marks	*ib.*
Appendices to the Carolina Paddy Report—	
Meteorology of South Carolina	137
Average Monthly Meteorological Registrations of the Madras Presidency ..	139
Madagascar Paddy	143
Appendices to the General Report—	
Expenditure of the Madras Agricultural Department	147

Read the following letter from W. R. ROBERTSON; Esq., M.R.A.C., Superintendent of Government Farms, to H. E. STOKES, Esq., Secretary to the Board of Revenue, dated Sydapet, 22nd December 1877, No. 1,085 :—

I HAVE the honor to submit my annual report for the official year ending 31st of March 1877. A report on the results of the experimental culture of Carolina paddy in this Presidency forms a part of the annual report; this portion has however, in accordance with the directions of the Board, been already separately submitted.

2. As directed in the Proceedings of the Board, Miscellaneous No. 8,076, dated the 5th of June 1877, I forwarded to the Director of Public Instruction a copy of the portion of the report that refers to the Agricultural College.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS,

FOR THE

YEAR ENDING 31ST OF MARCH 1877.

INTRODUCTORY.

THE history of agriculture in this Presidency, during the past year is one continuous record of disaster, due chiefly to the unpropitious character of the weather. Hence, the operations of this Department were not so extensive as they would otherwise have been. Nevertheless, a good deal of useful work was done, and numerous facts gathered which cannot but prove useful in suggesting the direction, in which efforts should be made to avert from our agriculture, such calamitous results as those which were so severely experienced during the past year.

No District tours were undertaken by any of the Officers of the Department as, from the almost entire cessation of all agricultural work, it was thought that no good could result from such tours.

The Agricultural Exhibition, which was to have been held in February last, was again postponed.

The Agricultural College was opened in October last, and is now in full operation. It is gratifying to note that numerous applications for admission into it, were received from all parts of India and, in many instances from well-educated youths, likely to benefit from the instruction afforded in the institution, and, prove of use afterwards in the great work of agricultural improvement. The organization of the institution necessarily demanded much careful attention, and occupied a good deal of time. But, the results that have been secured and those that promise to follow, will fully compensate for the labor and time expended.

The drought, of course, proved very detrimental to the cultivation of the Sydapet Experimental Farm. The necessity of providing food for the large number of cattle and sheep on the Farm, prevented the carrying out of any extensive experiments on the land where irrigation water was available. However, the crops produced without irrigation water were, in several instances very satisfactory, especially those sown early; one crop of Sorghum Saccharatum, as will be noticed on perusing the Farm Report, yielded 5,000 lbs. of straw and 924 lbs. of grain, per acre; while, crops of Yellow Cholum and Planter's Friend yielded from 300 to 450 lbs. of grain and 2,500 to 4,000 lbs. of straw, per acre. The advantages that result from deep culture were very clearly shown in the past year. The most casual observer, in looking over the crops during the drought, could not have failed in noting the remarkable superiority of the plants growing on the deeply tilled soil, compared with those growing on the head-lands of the fields and other shallow cultivated land.

The appointment of Inspector of Cattle Diseases, was vacant during the year, Veterinary Surgeon Western who held it, having vacated the appointment for other duties. Veterinary Surgeon Adams was temporarily employed in connection with the outbreak of cattle disease in Wynaad and Coorg. Efforts are being made in Europe to procure a qualified Veterinarian for the vacant post. It is evident however from past experience that one Veterinary Inspector can effect but little good in dealing with a horned-stock amounting to about eight and a quarter million head, scattered over an area of about twenty-five million acres. It has been suggested that the Inspector should have stationed at the head-quarters of each District, an Assistant, of the grade of an Apothecary; such Assistants to be trained in the Agricultural College where, instruction is afforded in Veterinary Surgery.

It has been determined to make these annual reports something more than mere records of the condition and operations of the Department, in view to rendering them more generally useful. To this end, papers on agricultural subjects of interest, and, short reports on agricultural matters that have been submitted to the Board of Revenue, either by District Officers or, Officers of this Department, will be published with the annual reports. With the present report, there is not much of interest to be published regarding the agriculture of the Districts, due to the great difficulties that stood in the way of carrying out field experiments and, to the attention of those from whom otherwise reports might have been expected, having been absorbed in efforts for the preservation of the lives of those engaged in agriculture. A few papers are published which, it is believed, will prove useful to those engaged in agricultural pursuits.

The correspondence of the Department continues to increase and, as the increase is caused chiefly by more frequent communications with persons engaged in agriculture in various parts of the Presidency, this is very encouraging. Aid, in the shape of advice founded on experience, is willingly accepted from all who choose to afford it, and every effort is made to encourage inquiries, in this way valuable agricultural information is collected and diffused amongst those interested.

WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

SYDAPET EXPERIMENTAL FARM.

SECTION I.

GENERAL.

1. *Rainfall.*—It is of far more importance for an agriculturist to know how the rain of a district falls, as a guide to the climate of it, than the total fall. If rain is precipitated in heavy falls at intervals of considerable duration, the cultivation of unirrigated lands must be a matter of difficulty, whilst for irrigated lands heavy falls are advantageous by filling the tanks, &c.

Importance of knowing character of fall.

2. Judging from the statement given below, the rainfall register in this country is not of much use to the agriculturist, as the seasons are so uncertain and varying; it only tells, what general observation has already discovered, the distribution of rainfall during the year:—

Register poor guide.

—	1870-71.			1871-72.			1872-73.			1873-74.			1874-75.			1875-76.			1876-77.			Sydapet Farm Average 7 Years.				Observatory Average 63 Years.	
		Falls.			Falls.			Falls.			Falls.			Falls.			Falls.			Falls.			Daily Falls.				
	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Total.	Rainfall.	Wet Days.
April	..	..	..	..	..	..	..	..	..	2·38	2	1	..	..	..	..	..	..	·81	1	..	·46	·43	·14	·57	0·71	1
May	..	..	..	·33	1	..	7·55	1	2	..	..	..	6·79	2	1	..	..	..	·55	3	..	2·17	1·00	·43	1·43	2·07	2
June	8·32	6	2	1·44	4	..	1·41	1	1	1·68	6	..	6·66	4	3	·32	4	..	2·82	3	1	3·22	4·00	1·00	5·00	1·99	7
July	8 48	8	3	6·44	4	2	2·95	5	1	1·50	9	..	5·46	7	1	·66	3	..	3·67	11	..	4·16	6·71	1·00	7·71	3·81	12
August	7·52	5	3	1·79	3	..	6·46	7	2	3·16	6	1	2·34	4	1	9·44	10	2	3·69	7	1	4·88	6·00	1·43	7·43	4·53	12
September	6·90	5	2	8·23	1	4	4·96	5	2	7·24	5	2	10·59	9	3	4·21	4	1	2·10	3	1	7·32	4·57	2·14	6·71	4·83	10
October	16·63	8	4	6·21	5	2	18·26	5	5	12·30	11	7	21·91	3	7	5·30	10	2	3·34	3	2	11·99	6·44	4·14	10·58	10·99	12
November	5·44	11	1	26·64	7	7	31·13	6	10	8·91	13	1	9·25	3	4	15·52	6	5	3·74	4	2	12·37	7·14	4·29	11·43	13·17	13
December	1·20	3	..	·19	1	..	7·22	2	3	10·90	2	3	5·11	3	2	2·99	6	1	·14	3	..	4·12	2·86	1·29	4·15	5·10	7
January	1·20	1	1	..	..	..	..	..	..	..	..	..	·10	1	..	..	..	..	·02	1	..	·73	·43	·14	·57	·99	2
February	·68	1	..	·75	1	..	6·23	2	2	..	..	..	..	..	..	..	..	..	..	..	..	1·11	·57	·29	·86	·30	1
March	·70	2	..	·06	1	..	..	..	..	..	..	..	·77	1	..	..	..	..	..	..	..	·19	·57	..	·57	·45	1
Total ..	57·07	50·	16	52·08	28	15	86·17	34	28	46·07	54	15	68·98	37	22	38·44	43	11	20·88	39	7	52·72	40·72	16·29	57·01	48·94	80

Amount and season of fall irregular.

From this statement it will be observed that, during the past seven years, the average rainfall of any one month has only in eight or nine cases approximated to the average registered during the past 60 years at the Madras Observatory, which is only 3 miles off. Comparing the average of the past 7 years here, with that of the past 60 years at the Observatory, the total for the year is 5 inches more; this excess occurring chiefly in September and June, whilst in December there is a deficiency.

Proportion of heavy falls large.

3. The usefulness of gentle showers at frequent intervals is acknowledged, and the statement endeavours in a measure to bring out the character of the rainfall by dividing the light and the heavy falls; it will be noticed that during the past 7 years 29 per cent. of the daily falls have been over 1 inch, varying from 45 per cent. in 1872-73 to 15 per cent. in 1876-77. In seven months only of the year is there usually a sufficient frequency of rain, that is from June to December inclusive; but, the monthly register is often delusive, as, owing to the high temperature that usually prevails, if a considerable lapse occurs between two falls of rain, all the bad effects of a prolonged drought will be seen, and although there may be an entry of a heavy rainfall and a large number of wet days in a month, that month may be most unpropitious for cultivation.

Great deficiency.

4. *Season.*—The season has been a most unfortunate one for the agriculturist generally, more especially for the wet-land cultivator; for dry lands there was, as will be shown further on in this report, sufficient rain to mature fair crops of cereals, pulses, cotton, and indigo. The total deficiency of the rainfall from the average of the past 10 years was 29·38 inches, whilst the proportion of wet days to rainfall was higher, there being only 22 days fewer on which rain was registered, than the average.

5. Rain fell during April on only one day, which is about what is usually the case; in May 3 slight falls amounting in all to ·55 inches did not attain the average of 10 years by nearly an inch; during June, the same contrast with the average of previous years continued, the rainfall being only 2·82 inches on 5 days to an usual 3·14 inches in 6 days. July was marked by numerous small showers, falling chiefly during the latter part of the month according to the general custom, which, though more numerous than usual, the register shows to have been lighter. In August very light showers, instead of the usual falls of medium amount were, until the last week, registered, these were insufficient for cultivation, but tended to promote the growth of weeds; in the last week however a considerable fall occurred, which would, had September continued as it began, have enabled dry crops to have been grown with ease, and what were sown would not have been ruined by the drought, which set in after the 5th of that month, and to which must be attributed much of the loss of crop on dry lands during the past season; the deficiency of rainfall during these two months was 4·76 inches, whilst there were 7 fewer wet days. The failure of the north-east monsoon rains in October and November was the cause of the failure of the wet crop, because the tanks, which these rains usually replenish, were not filled; the deficiency of rain amounted to nearly 16 inches and there was a corresponding decrease in wet days. In December the same failure continued; and during the three concluding months of the year there was scarcely any rain, only a very slight shower in the middle of January, and a sprinkling in March too slight to register.

6. The following table gives the monthly falls of the present compared with that of the past 10 years:—

—	1876-77.		Average of 10 Years.		—	1876-77.		Average of 10 Years.	
	Inches.	Wet Days.	Inches.	Wet Days.		Inches.	Wet Days.	Inches.	Wet Days.
April	·81	1	·26	·6	November ..	3·74	6	13·00	12·3
May	·55	3	1·48	·9	December ..	·14	3	5·40	6·0
June	2·82	5	3·14	6·6	January ..	·02	1	1·08	1·4
July	3·67	11	4·15	8·8	February ..	..	..	·89	·8
August ..	3·69	8	5·02	9·8	March	..	..	·16	·5
September ..	2·10	4	5·53	9·0					
October ..	3·34	5	10·05	11·1	Total ..	20·88	47	50·16	67·8

7. In the next statement the rainfall of each week in the year is shown, this brings out more clearly the character of the season than the monthly statement does.

No. of the Week.	1876-77.		Average of the previous 10 Years.		No. of the Week.	1876-77.		Average of the previous 10 Years.	
	Inches.	Wet Days.	Inches.	Wet Days.		Inches.	Wet Days.	Inches.	Wet Days.
1st Week ..	..	..	·22	·2	27th Week ..	1·34	1	1·30	1·8
2nd do. ..	..	..	·03	·2	28th do. ..	1·01	1	1·22	1·4
3rd do. ..	..	..	..	..	29th do. ..	·54	1	3·52	3·6
4th do. ..	..	..	·01	·2	30th do. ..	..	..	3·45	3·6
5th do. ..	·81	1	1·34	·5	31st do. ..	·45	2	1·39	1·9
6th do. ..	·48	2	·07	·1	32nd do. ..	·12	1	2·14	2·1
7th do. ..	..	..	·04	·2	33rd do. ..	2·07	3	3·07	3·1
8th do. ..	..	..	·002	·1	34th do. ..	..	..	2·87	3·3
9th do. ..	·82	2	·001	·1	35th do. ..	1·55	2	4·25	3·2
10th do. ..	..	..	1·10	1·2	36th do. ..	..	..	3·58	2·2
11th do. ..	1·65	2	1·12	1·9	37th do. ..	..	..	1·18	1·9
12th do. ..	..	..	·40	1·7	38th do. ..	..	..	·51	1·0
13th do. ..	·42	2	·41	1·5	39th do. ..	·14	3	·09	·7
14th do. ..	..	..	·35	1·3	40th do. ..	..	..	·02	·4
15th do. ..	·72	4	1·21	1·7	41st do. ..	..	..	·003	·1
16th do. ..	1·22	3	1·05	2·9	42nd do. ..	·02	1	·47	·7
17th do. ..	·93	3	1·04	2·2	43rd do. ..	..	..	·59	·4
18th do. ..	·80	1	1·20	2·1	44th do. ..	..	..	..	..
19th do. ..	·22	1	1·48	2·6	45th do. ..	..	..	·70	·6
20th do. ..	·40	2	·75	2·0	46th do. ..	..	..	·002	·1
21st do. ..	·36	2	1·33	2·1	47th do. ..	..	..	·12	·1
22nd do. ..	2·71	3	·94	2·1	48th do. ..	..	..	·14	·2
23rd do. ..	1·81	2	1·20	1·9	49th do. ..	..	..	·08	·4
24th do. ..	·01	1	1·30	2·1	50th do. ..	..	..	..	..
25th do. ..	..	..	1·73	2·1	51st do. ..	..	..	..	..
26th do. ..	·28	1	·93	1·7	52nd do. ..	..	..	..	..

8. In the statement below the daily registrations of the year are given :—

April 1876.		May 1876.		June 1876.		July 1876.		August 1876.		September 1876.	
	Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
1 ..	..	1 ..	..	1 ..	·75	1 ..	..	1 ..	..	1 ..	..
2 ..	..	2 ..	..	2 ..	..	2 ..	..	2 ..	..	2 ..	..
3 ..	..	3 ..	..	3 ..	..	3 ..	..	3 ..	..	3 ..	..
4 ..	..	4 ..	..	4 ..	..	4 ..	..	4 ..	..	4 ..	·57
5 ..	..	5 ..	..	5 ..	..	5 ..	..	5 ..	..	5 ..	1·24
6 ..	..	6 ..	·41	6 ..	..	6 ..	..	6 ..	..	6 ..	..
7 ..	..	7 ..	·07	7 ..	..	7 ..	..	7 ..	..	7 ..	..
8 ..	..	8 ..	..	8 ..	..	8 ..	·07	8 ..	·22	8 ..	..
9 ..	..	9 ..	..	9 ..	..	9 ..	..	9 ..	..	9 ..	..
10 ..	..	10 ..	..	10 ..	..	10 ..	..	10 ..	..	10 ..	..
11 ..	..	11 ..	..	11 ..	..	11 ..	..	11 ..	..	11 ..	·01
12 ..	..	12 ..	..	12 ..	..	12 ..	·25	12 ..	·32	12 ..	..
13 ..	..	13 ..	..	13 ..	..	13 ..	·25	13 ..	..	13 ..	..
14 ..	..	14 ..	..	14 ..	·40	14 ..	·15	14 ..	..	14 ..	..
15 ..	..	15 ..	..	15 ..	..	15 } ..	·95	15 ..	·08	15 ..	..
16 ..	..	16 ..	..	16 ..	1·25	16 }		16 ..	..	16 ..	..
17 ..	..	17 ..	..	17 ..	..	17 ..	..	17 ..	..	17 ..	..
18 ..	..	18 ..	..	18 ..	..	18 ..	..	18 ..	·28	18 ..	..
19 ..	..	19 ..	..	19 ..	..	19 ..	..	19 ..	..	19 ..	..
20 ..	..	20 ..	..	20 ..	..	20 ..	·27	20 ..	..	20 ..	..
21 ..	..	21 ..	..	21 ..	..	21 ..	..	21 ..	·08	21 ..	..
22 ..	..	22 ..	..	22 ..	..	22 ..	·65	22 ..	..	22 ..	..
23 ..	..	23 ..	..	23 ..	..	23 ..	·05	23 ..	..	23 ..	..
24 ..	..	24 ..	..	24 ..	..	24 ..	..	24 ..	..	24 ..	..
25 ..	..	25 ..	..	25 ..	·11	25 ..	·23	25 ..	·53	25 ..	..
26 ..	..	26 ..	..	26 ..	..	26 ..	..	26 ..	..	26 ..	·28
27 ..	..	27 ..	..	27 ..	..	27 ..	..	27 ..	1·90	27 ..	..
28 ..	..	28 ..	..	28 ..	..	28 ..	..	28 ..	..	28 ..	..
29 ..	..	29 ..	..	29 ..	·31	29 ..	..	29 ..	..	29 ..	..
30 ..	·81	30 ..	·07	30 ..	..	30 ..	..	30 ..	·28	30 ..	..
		31 ..	..			31 ..	·80	31 ..	..		
Total ..	·81	Total ..	·55	Total ..	2·82	Total ..	3·67	Total ..	3·69	Total ..	2·1

October 1876.	November 1876.	December 1876.	January 1877.	February 1877.	March 1877.
Inches.	Inches.	Inches.	Inches	Inches.	Inches.
1 .. 1·34	1	1	1	1	1 .. ..
2	2	2	2	2	2 .. ..
3	3	3	3	3	3 .. ..
4	4	4	4	4	4 .. ..
5	5	5	5	5	5 .. ..
6	6	6	6	6	6 .. ..
7 .. 1·01	7	7	7	7	7 .. ..
8	8	8	8	8	8 .. ..
9	9 .. ·12	9	9	9	9 .. ..
10	10 .. 1·04	10	10	10	10 .. ..
11	11 .. 1·01	11	11	11	11 .. ..
12	12 .. ·02	12	12 .. ·02	12	12 .. ..
13	13	13	13	13	13 .. ..
14	14	14	14	14	14 .. ..
15	15	15	15	15	15 .. ..
16	16	16	16	16	16 .. ..
17 .. ·54	17	17	17	17	17 .. ..
18	18	18	18	18	18 .. ..
19	19	19	19	19	19 .. ..
20	20	20	20	20	20 .. ..
21	21	21	21	21	21 .. ..
22	22	22	22	22	22 .. ..
23	23	23	23	23	23 .. ..
24	24	24 .. ·10	24	24	24 .. ..
25	25	25 .. ·03	25	25	25 .. ..
26	26	26 .. ·01	26	26	26 .. ..
27 .. ·30	27	27	27	27	27 .. ..
28 .. ·15	28	28	28	28	28 .. ..
29	29 .. ·85	29	29		29 .. ..
30	30 .. ·70	30	30		30 .. ..
31		31	31		31 .. ..
Total .. 3·34	Total .. 3·74	Total .. ·14	Total .. ·02	Total .. *Nil.*	Total .. *Nil.*

9. *Establishment.*—At the end of October, on the opening of the Agricultural College, the class of Sydapet Farm Apprentices was abolished; other than this there were no changes in the establishment, and the conduct of all the members of it was generally satisfactory.

SECTION II-A.

CULTIVATION AND CROPS.

10. *Rotations and their value.*—Experience has shown that the continuous cropping of land with one crop, or with crops of close affinity, for a long series of years successively, renders the soil unproductive. To this exception may be made of lands so situated that they annually receive a deposit of silt from some river, or of lands to which, after each successive crop, manure containing the plant food removed by it is applied. The last-named system, although capable of maintaining the land in a permanent state of fertility, has been found not to be generally economical.

Continuous cropping exhausts the land unless certain conditions are fulfilled.

11. To overcome the difficulties mentioned, the alternation of the growth of different crops was adopted, and has been proved to be most effective.

12. The theory of rotations is explained by Boussingault as follows :—

"In reviewing the chief points examined, it will be seen that, as far as regards organic matter, the systems of culture which in borrowing most from the atmosphere, leave the most abundant residues on the land, are those which constitute the most productive rotations. In respect to inorganic matter, the rotation to be advantageous, to have an enduring success, ought

to be so managed that the crop exported should not leave the dunghill with less than that quantity of mineral substances which it ought to contain."

A leguminous good preparation for a cereal crop.

13. A leguminous plant if grown before a cereal has been found to have marked effect on the succeeding crop, even if the leaves, stems and grain be removed. This is explicable from the great richness in nitrogenous matters, which are so much needed for the growth of cereals, that the roots of leguminous plants possess. A knowledge of the effect of leguminous crop, as a manure for cereals, is shown when the ryot grows a crop of black or green gram (*Phaseolus*) on wet lands for the benefit of the succeeding crop of paddy; although, in this case it may be said, that the leaves and stems are returned, and so cause the increase of production, yet, if the experiment of grazing the gram crop with sheep were tried, the result would, there is no doubt be more profitable.

A grain more exhaustive than a fodder-crop.

14. It has been proved that, when a crop is grown for seed, the soil has much more phosphorus, potassium, &c. removed from it than if the crop be grown for its leaves and stems only. Thus it is that a crop cut green for fodder does not exhaust the land so much as a crop that is allowed to mature its seed.

Variable amount of ash constituents in different plants.

15. The analyses of the ashes of different plants show that their composition is very similar in the same family, but that those of different families vary greatly. Thus the ash of leguminous crops is usually rich in lime, and that of cereals in silica. From this habit the advantages of alternating crops may be in a measure explained, as it is known that, although an analysis may show a soil to contain all the elements required for the growth of a particular crop, a further examination into the state in which these constituents exist may show that some element, especially required by the crop it is intended to grow, is only present in a condition in which it is practically unavailable in sufficient amount to produce a good crop.

Cultivation and nature change constituents of soil.

16. It is known that by the operations of cultivation, and by the forces of nature, the constituent parts of a soil become gradually changed in their composition, so that, although in one year, a piece of land may be unable to grow a *profitable* cereal crop, it may in a second be able to do so, even if, during the first year, a crop of another family be grown on it.

Root growth of plants varies.

17. Research has also shown, that the roots of different plants seek for and absorb their food in different parts of the soil, some going into the subsoil, some only subsisting on the surface. By alternating crops which seek their food in different parts of the soil, it is possible to allow some portion of it to lie fallow. And here it may be remarked that the roots of plants open up and aërate the soil; if a plant be deep-rooted, by penetrating downwards it places a greater depth of soil at the service of the cultivator; if its roots be wide-spreading, they increase the organic matter in the surface, and aërate it also when they decay, thus improving the physical condition wherever they go.

Encouragement and obstacles to weeds.

18. Some crops encourage the growth of weeds, owing to the difficulties their habit of growth presents to thorough interculture; other crops, by the dense covering they afford, kill out many weeds which would otherwise become overwhelming; again there are other crops which it is possible to cultivate, hoe, and weed, thoroughly during their growth. Thus by adopting rotations the land may be kept clean and be benefited by the continual culture it experiences under some crops.

Destruction of insects.

19. Some crops are attacked by particular insects, which deposit their larvæ in the ground wherever the crop on which they are feeding is growing. If the same crop be taken on this land successively it will suffer more and more from insect attacks, whilst if different descriptions of crop be grown, the insect, being deprived of its food, would probably die.

Economy of labor.

20. It is the object of every agriculturist to economise labor, and to do this efficiently, the seed-time must be extended over as long a period as possible. In temperate climates, the seed-time extends

throughout nearly the whole year. Here owing to the character of the season, it is not possible to extend the seed-time very much; but to a certain extent it is, and, in constructing a rotation for any locality, the climate, having a most important part to play as regards the Labor Bill, must be carefully considered.

An applicable rotation.

21. As a rotation for dry lands applicable to many soils; including amongst the crops suggested two of the most valuable products commonly grown in Southern India; providing an adequate supply of food for man and beast; not presenting a system of exhaustive culture, in too repeatedly growing the same crop or description of crop; and enabling the land to be kept free from weeds, the following may be suggested:—

1st year—Corn crop and cotton.
2nd year—Indigo.
3rd year—Corn crop followed by a catch crop of gram.
4th year—Guinea grass.
5th year—Guinea grass.

22. This would give annually on a 20-acre holding—

8 acres of corn.
4 acres of indigo.
4 acres of cotton.
8 acres of grass.

Crops chiefly consumed on the land.

23. The only crops in such a rotation, which would actually be sold off the land, would be the cotton and indigo; the corn crop being used for the support of the cultivator, his family, and of such laborers as he employed, would not be lost, as the ordure and rubbish from their houses might be collected and returned to the land.

Cotton provides cattle-food and fuel.

24. The cotton seed would provide food for the cattle, and if there were a surplus of corn grown, a portion might be sold and an equivalent amount of cattle food or manure purchased. The cotton stalks would provide some fuel for household use, and the ashes left from them would form a valuable addition to the compost heap.

Indigo not an exhaustive crop but manural.

25. Indigo should not be an exhausting crop under skilful management. The dye is the only product that must be removed; the refuse from the vats, consisting of nearly the whole plant, being brought back, would when rotted form a valuable manure. Indigo, the roots of which penetrate deeply, thus tending to open up and aërate the soil and so improve it, would leave the land in a condition fit to carry the second corn crop of the rotation, which however should receive a top-dressing of some manure, such as saltpetre, the value of it being recouped by a sale of a portion of the grain grown.

26. If a gram crop were grown it should be used as a manure, either by being fed off with sheep, or by being ploughed into the land green; the latter mode of manuring is most efficacious in many instances, especially when the soil is retentive or apt to set, and also when it is deficient in organic matter.

Guinea grass good fodder—under it land fallowed.

27. The two years under guinea grass might be reduced to one on many lands, and would take the place of the system now practised of leaving land "waste"; under this grass, the land would produce a good crop of fodder; be kept in continual cultivation; cleaned of weeds, and the insects and parasites which might have attacked the previous crops would die out, so that, at the end of the rotation, the land would be left in good heart to grow the first crop of the next series.

Rotation for stronger soils.

28. On stiff strong rich soils, instead of planting guinea grass in the fourth year, an early sown cholum crop, cut green for fodder, followed by a leguminous crop, such as black or green gram, which, being harvested in the early part of the year, could be succeeded by a summer crop of gingelly; in the fifth year indigo might again be taken, followed

in the sixth year by a corn crop, in the seventh and eighth years by guinea grass. The rotation would then run as follows:—

1st year—Corn and cotton.
2nd year—Indigo.
3rd year—Corn and gram as summer crop.
4th year—Cholum cut green, followed by a leguminous crop and by gingelly as a summer crop.
5th year—Indigo.
6th year—Cholum and gram as catch crop.
7th and 8th years—Guinea grass.

29. Another variation might be made, instead of indigo in the fifth year corn and cotton might be introduced, and another year added to the rotation, which would then become a nine-course one.

Value incalculable.

30. *Deep Cultivation.*—Year by year experience of the results seen on this farm confirms the opinion, "that the *value* of deep culture can, for usefulness in India, be scarcely overrated." The past year has been more fruitful than ever in facts demonstrating this point. Those fields, which were more deeply cultivated, gave better returns than others in which so deep a tilth was not obtained; and in all, the head-lands, which, owing to the constant treading of the cattle in turning, were not so deeply cultivated as the rest of the field, presented a most marked difference in the crop they produced.

31. The table given below is a statement of the results of the deep cultivation of the body of a field, contrasted with those produced by the shallow cultivation of the head lands:—

No. of Field.	During Growth.		Duration of Growth.	Nature of Cultivation.	Area of Plot.	Yield of Straw.	Yield of Straw per Acre.	Yield of Grain.	Yield of Grain per Acre.
	Rainfall.	Wet Days.							
					SQUARE YDS.	LBS.	LBS.	LBS.	LBS.
16	·16	3	87 days.	Deep ..	16,027	11,456	3,459·6	221	66·7
				Shallow.	2,180	216	479·5	4·5	9·99

Deep cultivation gave seven times more produce.

32. It will be seen, that from the more deeply cultivated part of the field the yield of straw was at the rate of 3,459 lbs. per acre, whilst, from the head-lands it was only about 480 lbs., or less than one-seventh; the outturn of grain was in both cases very small, but, as the head-lands only yielded at ⅐ the rate the rest of the field did, the effects of deep culture are equally obvious.

33. The whole field had been heavily manured throughout, and if anything the head-lands received more than their share of the manure.

Effects of droughts intensified by shallow culture practised generally.

34. Seeing that the head-lands were cultivated fully as deeply and as well as is the ordinary practice of the country, this case shows what may be done, towards lessening the effects of the droughts we suffer from, by adopting a deeper tillage of the soil; for during the growth of this crop only ·16 inches of rain fell. The seed was sown after a week's dry weather, which followed a fall of 1·55 inches, before which there had been no rain at all for more than a fortnight. The point here brought out is of vital importance, for, if fodder could be produced in such quantities as were in the case referred to, there would never be such terrible losses of cattle, as there have been during this year. Although in this case the yield of grain was very low, during the same season with other crops planted at an earlier date, and thus receiving more rain, 300 to 500 lbs. of grain per acre were produced under similar management.

Fodder at least provided in case of droughts.

35. *Small and large Fields.*—A further consideration of the table given in paragraph 31 shows the advantage of having large fields instead of small; in that the proportionate area of head-lands is much less.

Great loss of crop from small.

36. In this case, in a field of 3¾ acres, 12 per cent. of the area was taken up with head-lands, this caused a loss, from the stunted crop which grew on the head-lands, of 1,307 lbs. straw and 25½ lbs. of grain, worth about Rupees 7-8-0, or about Rupees 2 per acre. If the field had been smaller, the loss per acre would have been heavier, as the width of the head-land must in all cases be nearly the same.

Costly to work small.

37. For economy of working, long and broad fields, provided they are not too long for the cattle to plough from end to end without a pause or check, are far superior to short and narrow ones, as the time consumed in turning is less proportionately to that whilst at work than in short fields.

All boundaries need nurseries.

38. In small fields the boundaries between each field occupy a considerable percentage of the area of cultivated land, whilst, if the fields are large, this area forms only an insignificant portion of the total. Every boundary, whatever it consists of, forms a nursery for weeds from which their seeds can be distributed to the land around, so that the fewer and smaller these nurseries are the better.

39. *Crops grown.*—The following table gives the outturn of several crops grown during the past season, and is worthy of notice :—

1	2	3	4	5	6	7	8
Description of Crop ..	Sorghum.	Planter's Friend.	Yellow Cholum.	Yellow Cholum.	Yellow Cholum.	Yellow Cholum.	White Cholum.
Number of Field ..	4	34	33	32	14	18	16
	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.
Area of Plot	8,470	6,930	17,632	22,990	4,985.	19,602	18,207
Date of sowing ..	17th October 1876.	18th October 1876.	10th October 1876.	5th October 1876.	9th October 1876.	15th Nov. 1876.	8th Dec. 1876.
Amount of seed sown..	14 lbs.	40 lbs.	75 lbs.	120 lbs.	50 lbs.	76 lbs.	73 lbs.
Seed sown per Acre ..	8·00 lbs.	27·93 lbs.	20·58 lbs.	25·26 lbs.	48·54 lbs.	18·76 lbs.	19·40 lbs.
Date of reaping ..	24th Jan. 1877.	31st Jan. 1877.	15th Jan. 1877.	5th Jan. 1877.	22nd Jan. 1877.	13th Feb. 1877.	3rd March 1877.
Duration of growth ..	100 days.	106 days.	98 days.	93 days.	106 days.	91 days.	87 days.
During growth—							
Rainfall	4·75 in.	4·35 in.	4·75 in.	5·74 in.	4·75 in.	1·71 in.	·16 in.
Wet days	13	12	13	14	14	6	3
Yield of—							
Straw	8,948 lbs.	5,600 lbs.	10,096 lbs.	11,928 lbs	4,085 lbs.	10,328 lbs.	11,672 lbs.
Grain	1,615 lbs.	650 lbs.	1,640 lbs.	1,525½ lbs.	* 164 lbs.	480 lbs.	225½ lbs.
Yield per Acre of—							
Straw	5,103 lbs.	3,911 lbs.	2,771 lbs.	2,511 lbs.	3,964 lbs.	2,540 lbs.	3,103 lbs.
Grain	924 lbs.	454 lbs.	450 lbs.	321 lbs	*159 lbs.	118 lbs.	560 lbs.

* A large amount of the produce of this field was stolen which causes the low outturn.

Fair crops produced without irrigation.

40. From this statement it will be seen that crops sown early in October produced from 2,500 to 5,000 lbs. of straw, and from 320 to 920 lbs. of grain; whilst others sown later, although the outturn of straw was nearly as great, show a great falling off in that of grain; this must be attributed to the smaller amount of rain that fell during their growth.

Result attributable to good system of culture.

41. These results show in a great measure what may be done, even on light soils like that of this farm, to produce crops with even as light a rainfall as there was during the past year. The results may be attributed to the depth of cultivation, the value of which in a droughty season has already been dwelt upon, and to the manuring which all the fields received. In order to understand and appreciate the results shown in the statement, some remarks regarding each crop are given here.

42. The Sorghum crop was grown on a piece of light sandy loam, which had lain fallow during the previous year and was heavily manured with box manure; the crop was also top-dressed with saltpetre, and, to the thoroughly cultivated and high manural state of the land, the result obtained may be attributed. It will be seen that the seed sown was as little as could possibly be used with any good results, but it is probable

that, had the crop been slightly thicker on the ground, the results would have been better.

43. The crop of Planter's Friend was grown on a light soil of average quality, which had been extremely well cultivated: it only received as manure a top-dressing of saltpetre.

44. The two Yellow Cholum crops first on the table were grown in adjacent fields of similar quality; the difference in outturn may be attributed to the first field having been more thoroughly cultivated, and to the fact that the crop in it succeeded one of indigo; whereas in the second field the cholum followed a crop of maize and cotton, and further that in this field there were several more trees, which always cause a considerable diminution of crop on the land immediately surrounding them.

45. The third crop of Yellow Cholum was grown in a field, of very similar quality to the last, which had been most thoroughly cultivated, and had received a good dressing of manure.

46. The last crop of Cholum on the table was grown on a light sandy field, which had been heavily manured with horse manure, and was top-dressed with a dressing of salt and dissolved Peruvian Guano. It should be observed how little rain this received during its growth, but in connection with this it must also be noted that, five days before the crop was sown, there was a fall of over 2 inches, which saturated the seed-bed, and thus enabled the seed to germinate.

47. The crop of White Cholum sown on December 8th is really a most wonderful crop, considering that during its growth all the rain it received was ·16 inches. The land was in good condition from deep cultivation and a heavy manuring of horse manure.

48. The following is a statement of the actual cost of production, and a valuation of the outturn, of the crops referred to in the table given in paragraph 39, excepting that grown in No. 14 field, which it is useless to include owing to the pilfering of the produce which took place:—

Crop.	Sorghum Saccharatum.			Planter's Friend.			Yellow Cholum.			Yellow Cholum.			Yellow Cholum.			White Cholum.		
Field grown in	No. 4.			No. 34.			No. 33.			No. 32.			No. 18.			No. 16.		
Area	SQ. YDS. 8,470			SQ. YDS. 6,930			SQ. YDS. 17,632			SQ. YDS. 22,990			SQ. YDS. 19,602			SQ. YDS. 18,207		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cost of seed	1	12	0	1	10	0	2	8	0	4	0	0	2	8	0	5	0	0
Labor in cultivation, &c.	24	6	0	18	15	0	41	12	6	43	12	6	25	0	0	41	15	0
Do. in harvesting, &c.	5	13	6	2	11	0	16	3	0	17	13	0	12	5	0	9	11	0
Labor and seed	31	15	6	23	4	0	60	7	6	65	9	6	39	13	0	56	10	0
Do do. per Acre	18	4	3	16	3	9	16	9	7	13	12	11	9	13	3	8	14	6
Cost of Manure	52	8	0	23	8	0	19	2	8	19	13	0	28	12	0	33	8	0
Do. do. per Acre	30	0	0	16	6	7	5	4	3	4	2	2	7	1	5	8	14	6
Value of Straw	30	3	6	22	6	5	40	6	2	47	11	4	41	4	11	46	10	0
Do. do per Acre	17	6	2	15	10	4	11	1	4	10	7	8	10	3	2	12	5	5
Value of Grain..	80	12	0	26	0	0	54	10	8	50	10	5	16	0	0	9	0	0
Do. do. per Acre	46	2	3	18	2	6	15	0	1	10	10	7	3	15	2	2	6	3
Gross Outturn	110	15	6	48	6	5	95	0	10	98	5	9	57	4	11	55	10	0
Do. do. per Acre	63	8	5	33	12	10	26	1	5	21	2	3	14	2	4	14	11	8
Gross Cost	84	7	6	46	12	0	79	10	2	85	6	6	68	9	0	90	2	0
Do. do. per Acre	48	4	3	32	10	4	21	13	10	17	15	1	16	14	8	17	13	0
Value of Manure carried to next crop.	26	4	0	12	12	0	9	9	0	9	14	0	14	6	0	16	12	0
Do. do. per Acre.	15	0	0	8	3	0	2	10	0	2	1	0	3	8	0	4	7	0

Cost of labor and manure.

49. The total area of the crops referred to is 19·39 acres. The gross cost was Rupees 454-15-2, or about Rupees 23-8-0 per acre, of which Rupees 9-3-0 was for the manure applied, and Rupees 14-5-0 for labor and seed; the cost of manure, it will be seen, varies in different cases from Rupees 4-2-2 up to Rupees 30-3-6 per acre, and the cost of labor and seed from Rupees 8-14-6 to Rupees 18-4-3.

Gross return.

50. The gross return per acre varies even more than the cost of production, for, though the average is Rupees 18-13-5, the crop of sorghum returned Rupees 63-8-5 and that of yellow cholum in No. 18 only Rupees 14-2-4 per acre.

51. The average gross return is less than the gross cost of production, but, if a valuation of the manural matters left in the soil after the first crop be deducted from the cost of production, it will be seen that a small balance per acre is netted; this, it must be remembered, is after paying a high price for hire of cattle and for cooly labor. Of the sum expended on labor, at least 50 per cent. would under ordinary circumstances represent the value of the labor of the ryot and of his family; this amount being the remuneration he would receive in growing such crops. It is further questionable whether the full cost of the labor expended on the crops referred to can be fairly charged to them, for a great deal of cleaning the land was done, the effects of which will not be lost for some time. The rates at which the produce was valued were, yellow cholum 30 lbs. per Rupee, straw 250 lbs. per Rupee, excepting in the case of sorghum a portion of which weighed green was only valued at 300 lbs. per Rupee, sorghum seed 20 lbs. per Rupee, and the planter's friend and white cholum seed 25 lbs. per Rupee; these prices are all exceedingly moderate for the season. And in reality, straw was at the time unobtainable for double the price named, and grain has since attained a much higher figure, and which could have been obtained if a market had been waited for.

Terms of valuation which are very low.

52. Maize (*Zea Mays*).—A plot measuring 2,418 square yards, was sown with this crop; and, under occasional irrigation, it produced, between November 8th and February 6th, 6,108 lbs. of fodder, which is at the rate of 12,226 lbs. per acre. The rainfall during the period of the growth of this crop was 3·90 inches, and it received 8 waterings; it was manured with about 12 loads of stable manure, and received a top-dressing of 50 lbs. of saltpetre.

Heavy crop of fodder.

53. Cotton (*Gossypium Indicum*).—The season prevented the usual sowings in September from succeeding, and it was not until nearly the end of November that any crop that was sown grew well; a plot sown then has thriven wonderfully, and, aided by the deep tillage of the land on which it is growing, been able to withstand the drought, yielding fairly—though of course not so heavily as it would in a good season; as the season is not completed the full details of the crop will be given in the next report.

Season unfavorable for, but fair crop obtained.

54. A point, which should have a most material influence on the selection of the seed-time for cotton, has until now received no attention; it is the period of the year during which the yield of lint from the cotton plant is greatest. As bearing on this point, in the statement given below, the results of the different ginnings of the cotton gathered during the season of 1876 are recorded:—

Period of greatest yield of lint not inquired into most important.

Date of Ginning.	Amount Ginned.	Amount of Lint.	Percentage of Lint.	Details of Gatherings.
	LBS.	LBS.		
28th February 1876 ..	445·5	154	34·57	128 lbs. gathered before 1st January. 102·5 lbs. do. do. in January. 115 lbs. do. do. in February.
12th May ,, ..	602	220	36·55	53 lbs. do. do. in do. 251 lbs. do. do. in March. 298 lbs. do. do. in April.
17th do. ,, ..	181	58	32·04	32 lbs. do. do. in do. 169 lbs. do. do. in May.
16th June ,, ..	146	48	32·88	Gathered between May 16th and June 10th.
18th July ,, ..	372	98	26·34	Gathered after June 10th.
4th August ,, ..	246	40	17·07	Gathered after July 18th.
16th do. ,, ..	212	59·5	28·07	
24th do. ,, ..	197·5	52	26·33	
1st September ,, ..	187	58	31·02	Gathered after August 24th.
25th do. ,, ..	72	21·5	29·86	
Total ..	2,661·0	809·0	30·40	

55. It will be noticed that there is a great variation in the yield of lint at different times of the year, the cotton gathered during the earlier months yielding a much higher percentage than that picked later on. Thus the percentage of lint in

the cotton gathered before June 10th was 34·92, and, in that which was gathered between June 10th and the end of August, it was only 24·28, or about 10½ per cent. less. The yield of cotton in seed, during the first of the above-named periods, was 74·75 per cent. of the total gathering. The gatherings in September show a very high percentage yield of lint, but, as it was an unseasonably dry month, especially after the first week, the outturn in it must be taken as exceptional.

Percentage highest in early months as well as greatest yield.

56. Looking at the rainfall of the four months—May, June, July, and August—it will be noticed that one inch less than the average of the past sixty years, or more than 3 inches less than that of the past ten years, was registered; the chief difference being in the fall during the month of May, so that the long dry season was rather more protracted than usual; no rain fell from December 17th of 1875 until April 30th, 1876, when, after a drought of about eighteen weeks, ·81 inch fell, followed by four slight falls before June 10th amounting in all to 1·30 inches, which falls, considering the temperature of the air, and the dryness of the soil at the time when they fell, could have little permanent effect.

57. From the results of the ginnings recorded, it appears that after July it would generally be undesirable to keep cotton on the land; for, not only is the outturn shown to be chiefly given in the early months of the year, and that the percentage of lint produced after June is low, but also, during the showery weather of July and August, it is most difficult to keep down the weeds, and in all probability, if the crop is kept on the land for a longer period in the hope of obtaining rather more yield, the succeeding crop will be endangered, and great expense will be necessitated to clean the land again.

Advisable to remove cotton after July.

58. It would be better to sow the cotton crop at an earlier date than has been customary; instead of September, August should be the month chosen; by this means, cotton-picking might begin at the end of December, instead of the end of January or the beginning of February which has been until now the usual season. By this means a longer gathering season during the early months of the year, when the percentage of lint is greater, the staple longer, the sample usually much cleaner and not stained with oil, would be obtained, and the temptation to keep the crop on the ground late in hopes of obtaining a further gathering would be lessened.

August sowing will give a longer gathering season.

59. Indigo (*Indigofera tinctoria*).—The growth of this valuable crop is attended with considerable difficulties. The seed-time, adopted on this farm, is usually characterised by very uncertain weather, and the difficulty, in obtaining as good a seed-bed for the seed as is requisite, is great, as well as the chance of a heavy fall of rain caking the surface of the ground, and thus preventing the young germs from coming through. When a fair plant has been secured, there is no crop that we possess more hardy and less subject to the influence of dry weather than indigo. Three cuttings can be easily taken from it during the season, and it can be removed in August or September in time to allow the land to be prepared for another crop.

In first stage growth difficult plant hardy.

60. On the 11th of December, a field of about 4 acres was sown with this crop, and, although the drought prevented a good even plant being secured over the whole field, the outturn has been most satisfactory, and points clearly to the good effects of deep cultivation. The crop was not watered, and received during the first five months it was on the ground ·16 inch of rain only. Full details of the crop will be given in the next report, for as yet the returns have not been all realized, but it may be remarked that the first cutting, which was reserved for that purpose, yielded 913* lbs. of seed, and the second 13,475 lbs. of green indigo which was sold for Rupees 34.

SPECIAL CROPS.

61. Locust or Carob Bean (*Ceratonia Siliqua*).—In 1866 some seedlings of this tree were obtained and planted on a piece of land in a good situation on this farm; but until this year they never produced any fruit. There are now 5 trees, only one of which, however is a female one.

Trees eleven years old.

* Valued at Rupees 61.

62. The trees were planted in a line, which arrangement, owing to the habit of the tree, is unadvisable, and might have explained the reason why no fruit had been produced before, were it not that the solitary female one has at last done so.

Tree diœcious—planting risky unless seedlings are grafted.

63. The risk which must always attend planting the tree, owing to its being diœcious (the male and female flowers being borne on separate trees), and there being no method of ascertaining the sex of the plant until it flowers, is forcibly illustrated in this case, as of five trees planted only one of them has turned out to be a female one. To overcome this, grafting the seedling should be adopted, as by grafting from known female and male trees, a certainty as regards the sex of the trees can be depended on; the grafts thus raised can afterwards be planted out at convenient distances, allowing a large number of female plants to each male one.

Trees small and make no progress.

64. The trees growing here are about 17 feet high, and the stems, at 1 foot above the ground, measure about 20 inches in circumference, but for the last few years they have made no apparent increase in size; this can scarcely be attributed to the climate, for the trees do not seem to suffer even in the hottest weather, but is probably due to the fact that the soil on which they are growing is deficient in lime.

65. The following extract from a paper by Dr. A. Voelcker, F.R.S., shows the nutritive and fattening qualities of the pod as a food:—

"Locust-meal, as will be seen by the following analyses of three samples analysed in my laboratory, contains in round numbers fully half its weight of sugar, and in consequence is very palatable and much liked by horses, sheep, and cattle.

"Composition of Locust, Carob-Bean, Meal.

—	No. I.	No. II.	No. III.
Moisture	17·11	12·61	14·22
Oil	1·19	1·08	·96
Sugar	51·42	50·30	54·07
Mucilage and digestible fibre ..	13·75	20·13	14·41
* Albuminous compounds ..	7·50	5·87	7·72
Woody fibre	6·01	7·14	5·88
Mineral matter (ash)	3·02	2·87	2·74
Total ..	100·00	100·00	100·00
* Containing nitrogen ..	1·20	·94	1·25

"In addition to the constituents mentioned in the preceding analyses, carob-beans contain variable quantities of butyric acid, which impart to the crushed beans or meal a peculiar flavor. The meal is deficient in albuminous compounds, and for this reason it is desirable not to feed cattle too freely upon it, but to mix it with peas or bean-meal, or decorticated cotton-cake, or similar feeding materials rich in nitrogenous compounds."

Useful as a condiment.

From the qualities that this extract shows it to possess, it is more suitable for use as a condiment than as a food for cattle and sheep. The same authority writes as follows regarding the hard seeds enclosed in the sweet pod referred to above:—

"The seeds are very hard and in an unbroken state very indigestible. However, when split and steamed for some time, they swell out and get soft, and in this condition may be given to cattle with advantage as a useful fattening food. A sample of locust-bean kernels or seeds recently analysed by me had the following composition:—

Moisture	11·19
Oil	·97
*Albuminous compounds (flesh-forming matters)	5·94
Mucilage, sugar, and digestible fibre	76·29
Indigestible woody fibre	3·62
Mineral matter (ash)	1·99
Total ..	100·00
* Containing nitrogen	·95

66. Buck-wheat (*Polygonum Fagopyrum*).—A plot of 1,300 square yards was sown with this crop, the seed having been obtained from Australia. It grew well and would in an ordinary season doubtless attain maturity without being watered, but in the present case it was necessary to do so.

67. The seed was sown on November 9th, and within ten weeks the crop was off the ground, leaving it ready for another. The yield was at the rate of grain 167 lbs., straw 1,136 lbs. per acre; but, under more favorable circumstances, it would, there is every reason to believe, yield better results.

Useful Crop.

68. The crop is useful as a preparation for a cereal, or as a green manure. The fodder is good food for cows, and the grain yields, after the husk has been removed, a meal rich in nutritive matters. As an alternative crop with the cereals, as a catch crop after an early one grown for fodder, or grown as manure, buck-wheat can be recommended.

69. Flax (*Linum Usitatissumum*).—Seed of this plant also was obtained from Australia, and was sown on a piece of land adjoining the last crop referred to. It grew well, and was very healthy, but did not attain great length (only about 21 inches), as it was sown at wide intervals for the seed.

70. Vetches (*Vicia Sativa*) and Rape (*Brassica Napus*).—Australian seed—were sown, but, although the seed germinated well, neither crop succeeded. The vetches were apparently unable to withstand the heat, and the rape was attacked by caterpillars.

71. A plot of Lucerne (*Medicago Sativa*).—Australian seed—was also sown, and has done well, but as the crop was kept for seed, no outturns have been recorded of it.

72. Two samples of wheat were obtained from Egypt, but, though they germinated and grew fairly at first, no grain was produced; this may have been owing to a want of sufficient water, to a higher temperature than is usual in Egypt, and to the lightness of the soil on which the crop was sown.

73. Samples of lentils and lupins were also obtained from Egypt, but did not succeed, although they germinated well.

HEDGE PLANTS.

74. Osage Orange (*Maclura Aurantiaca*).—The plants referred to in the last report, paragraph 179, as having been raised and doing well, nearly though not totally succumbed to the last hot season, but considering the duration and severity of it, the experiment is worth continuing, and some plants raised from another supply of Australian seed are now doing well.

75. *Kangaroo Thorn.*—Some seed of this plant, which is used to a considerable extent as a hedge-plant in Australia, was obtained, and a number of young seedlings raised from it are now doing well in the nursery. The plant appears to promise well, being covered with numberless small spines, and growing fast; it remains to be proved whether the extreme heats of this country will not be too great for it, and also whether the spines are sufficiently strong to prevent cattle from straying through a hedge of it.

76. The thorny shrub, referred to in paragraphs 154 and 155 of the last report, is doing fairly well; a large percentage of the cuttings obtained grew and rooted thoroughly; but the season has been against hedge-planting, so that further trials of it have not been made. The fences planted under the system mentioned in paragraph 157 of the same report are doing well, and, notwithstanding the season they have had to contend with, have formed fences far superior to what could be obtained in so short a time, if started from seed.

SECTION II-B.

MANURES.

77. *Top-dressing experiments.*—The results given in the following table, of a set of experiments made with top-dressings during the past season, are interesting and, notwithstanding the unpropitious character of the season for such, demonstrate several points very clearly :—

—	Produce.	Unmanured.		Saltpetre. Value per Acre, Rs. 12.		Saltpetre and Bone Charcoal. Value per Acre. Saltpetre Rs. 6, Bone Charcoal Rs 6.		Bone Charcoal. Value per Acre, Rs. 12.	
		A.	B.	A.	B.	A.	B.	A.	B.
		LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.
Yield of Plot	Straw ..	884	1,348	1,332	1,534	1,197	1,402	1,010	1,179
	Grain ..	112	108	124	118	105	124	110	95
Yield per Acre	Straw ..	3,536	5,392	5,328	6,136	4,788	5,608	4,040	4,616
	Grain ..	448	432	496	472	420	496	440	776
Increase per Acre over unmanured.	Straw ..	..	..	1,792	744	1,252	216	504	— 776
	Grain ..	..	..	46	30	— 28	64	— 8	— 52
				RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P	RS. A. P.	RS. A. P.
Value of Increase per Acre .	Straw .. / Grain ..	..	..	9 1 8	4 2 11	3 14 8	3 6 7	1 11 2	—5 3 2

78. The crop to which the top-dressings were applied was yellow cholum, following a heavily manured crop of maize and cotton ; it was sown on 5th October, and the manures were applied on the 20th of the same month ; during the whole time of growth, 193 days, there was only a rainfall of 5·74 inches in 14 days, and of this 1·59 inches fell before the 20th. The soil on which the crop was grown was a light sandy loam, not in very good condition. The seed was sown at the rate of 25 lbs. per acre and germinated well.

Good crop for droughty season.

79. It is interesting to note here that in Coimbatore District* on soils, none of which were so inferior as the one on which this crop was grown, in an ordinary season a crop of about 450 lbs. of grain is as much as can be expected per acre, which amount was attained without the use of top-dressing in this case.

80. The reason why in the B series the yield of straw should be more in every case than that in the A series, is hard to explain, excepting by the fact that the previous crop of maize had been more vigorous on the portion of the field in which the latter series were grown.

Saltpetre useful top-dressing.

81. The utility of saltpetre as a top-dressing is shown, though not so clearly as it would have been had the season been wetter and more conducive to vigorous growth ; although the increased return did not recoup the value of the manure applied, it is probable that there were manural matters of more value left in the soil than are required to make up the deficiency.

* *Vide* paragraph 138 of the Report of Superintendent of Government Farms on Coimbatore District for 1876.

82. Bone charcoal by itself is shown to be useless as a top-dressing, and from its insolubility in water this might be expected; but the effect apparently caused by it in Series B must be attributed to some cause in the soil on which the plot was situated, and not to the manure applied.

Bone charcoal inert.

83. The effects of a light dressing of saltpetre, at the rate of Rupees 6 per acre, mixed with bone charcoal, were better than those obtained with a heavy dressing. And seeing that the action of bone charcoal is apparently *nil*, the increase shown must be put down solely to the saltpetre; which however, though it does not recoup the full expenditure immediately, shows that the application of a dressing of medium quantity will be more certain of being repaid in the crop produced.

Light dressing more remunerative.

84. Another set of experiments, with dissolved guano as a top-dressing was made, but, owing to a large amount of the grain having been stolen from the field, the results cannot be reported; judging, however, from the yield of straw on the different plots this manure does not materially increase that portion of the produce.

Set of experiments ruined by pilfering.

85. Lime (*Calcium Carbonate*).—The use of this mineral as a manure in native agriculture is totally overlooked, and perhaps fortunately so; for if the ryot knew the stimulating qualities of a dressing of lime on the soil, he would soon deprive it of the small reserves of plant-food it contains, and leave it utterly barren. The mineral is easily obtainable in many localities and might be applied to some soils with great advantage, but it is not to be recommended for use except under enlightened management, for it has long been said of lime that "it enriches the father and impoverishes the son," in this referring to the use of it in excess. As a manure for leguminous crops it is very valuable; and its effects, on a crop of ground-nuts grown on the farm, were most marked, for it increased the yield of nuts 83 per cent. and that of straw 10 per cent.

Not used in native agriculture.

Great effect on crop of ground-nuts.

SECTION III-A.

LIVE STOCK.

86. *Cattle.*—To form a commencement of the stock-breeding experiment, referred to in paragraph 46 of the last report, four young bulls and three heifers were obtained in November from the Amrhut Mahal herds. The cattle of these herds are chiefly noted for their qualities as draught animals. The specimens received, which were selected ones, are of slight make and very deficient in depth and thickness, but from their activity are able to perform light work with rapidity.

87. Owing to the drought it was impossible to lay down the land under guinea grass which it had been intended to; and even had means been available for keeping good stock on the farm, the presence of the Commissariat slaughter-houses in its midst renders such a proceeding unadvisable, from the risk that would be run of importing disease into the herd.

Stock-breeding experiment delayed.

88. *Measurements of Cattle.*—The following table gives the measurements of some of the cattle of different breeds that are among the farm stock; and it should be borne in mind that all the cattle were rather low in condition when measured, excepting the old Aden bull.

Breed.	Age.	Height.				Girth.		Length.		Length of face.	Breadth between eyes.	Horns.			Weight.
		Behind hump.	At loins.	At set on of tail.	To breast bone.	Behind shoulder.	At flank.	From point of shoulder to buttock.	From nose to set on of tail.			Girth at bare.	Width between.	Length.	
		FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	lbs.
Half bred bull { Nellore .. / European. }	Aged.	4 8	4 8¼	4 6	1 11	6 3	6 11	4 4	9 3	1 11	1 0	0 9	0 7	0 11½	1,150
Aden bull	do.	4 0½	4 3[illegible]	4 1	1 9½	5 8½	5 9	4 3	8 4	1 7½	0 9	0 7	0 5	0 4½	847
Do.	3	3 7	3 9½	3 6	1 6	5 0	4 10	3 9½	7 9	1 8	0 9	0 6½	0 6	0 3	521
Do.	2	3 7½	3 10	3 7½	1 7	4 8	4 8½	3 7	7 0	1 6	0 9	None present.			491
Mysore bull "dark"	6	4 1¾	4 2	4 0	1 11½	5 4	5 8	4 ½	7 5	1 11	0 9½	0 11	0 2	1 5½	662
Do. "light"	6	3 11½	4 1½	4 0	1 7	5 3	5 5½	4 1	7 9	1 9	0 10	0 11	0 3	1 3	654
Do. "black"	4	3 8	3 10	3 9	1 10	4 5½	4 6	3 8	7 2	1 9	0 8	0 10	0 2	1 3½	360
Do. "speckled" ..	4	3 7	3 10	3 7	1 9	4 1½	3 11½	3 2	6 2	1 7	0 8½	0 8	0 2	1 0	290
Buffaloe bull "Guzerat black"	Aged.	4 7	4 6	4 3	1 9	6 9½	7 4½	4 5	8 9½	1 9½	0 11	1 2	0 10	1 2	1,219
Do. "Guzerat brown"	do.	4 7	4 7	4 3	1 9	6 3	6 6	4 4	8 8	2 0	0 10½	1 2	0 10	1 2½	911
Aden cow	do.	3 7½	3 9	3 5	1 8½	4 8	5 3	3 10	6 9½	1 6½	0 7½	0 5½	0 4	0 3½	490
Mysore heifer	4	3 6½	3 9	3 10	1 9	4 8	4 6	4 1	6 6	1 8	0 8	0 8½	0 2½	0 1	440
Do.	5	3 6½	3 11	3 10	1 9	5 1	5 0	3 11	6 10	1 8½	0 8½	0 8½	0 2	1 4	430

Fore quarters low.

89. In all the cattle it will be observed that they stand higher at the loins than behind the hump; this may be an advantage for draught purposes, by enabling them to throw more weight against the yoke.

Excessive length of leg.

90. The length of leg, in proportion to the depth of barrel, is brought out very clearly by the measurement of the height to the breast bone, and is an excessive and general defect in the cattle of the country. To further demonstrate this point, the table below gives the comparison in several instances:—

—	Black Bull.	Old Aden Bull.	Six years old Mysore Bull, dark.	Six years old Mysore Bull, light.	Black Buffalo.
Total height	100	100	100	100	100
Height to breast bone ..	41	44·3	47·2	40	38·2

From these figures the legginess of some of the Mysore cattle may be seen, and also the depth of barrel of the buffalo bull.

91. In the following table the height of several animals is compared with their girth, and it will be seen that, though the Aden bull is rather leggy, he is also of good girth, showing that his barrel is round, and that he is *thicker through in proportion* to his size than either the light-colored Mysore bull or the half-bred black bull:—

—	Black Bull.	Aden Bull, aged.	Mysore Bull, 6 years, dark	Mysore Bull, 6 years, light.	Black Buffalo Bull, aged.
Height	100	100	100	100	100
Girth	130·3	141·2	128·6	132·6	149

Girth compares badly with that of English breeds.

92. It is further interesting to note that the girth of the Aden bull, which is comparatively speaking considerable, when contrasted with that of English breeds, shows how small the cattle of the country really are. As an instance, it may be quoted that the prize bull-calves of the Devon, Hereford, and Short-horn breeds, shown at Warwick in 1859, girthed 5 feet 1 inch, 6 feet 1 inch, and 5 feet 9½ inches respectively; the animals from which these measurements were taken were of course in high condition, but, when their age is considered, the contrast is very marked.

Death-rate very low.

93. *Sheep.*—The management of the sheep flock has been the same during the past year as formerly, and has been most successful. The percentage of deaths, as shown by the following table, is remarkably low, for it will be seen that, with a flock nearly one-fourth larger than the average of the past three years, the death-rate has been less than half as great:—

—	1873-74.	1874-75.	1875-76.	1876-77.
Average number of flock ..	207	221	237	275
Number of deaths ..	16	24	21	11
Percentage of deaths ..	7·73	10·9	8·9	4
Rainfall of year	48·07 inch.	68·98 inch.	38·14 inch.	20·88 inch.

Absence of rain good for health of sheep.

94. The influence of the rainfall on the death-rate is very great; and in a dry year like the past one, as long as sufficient food could be provided for the sheep, the absence of those disorders of the bowels caused by eating the hastily-matured grass, which grows so rapidly during the usual monsoon rains, keeps it low. In 1874-75, which year was marked with the heaviest rainfall of the four referred to in the table, it will be

noticed that the death-rate was highest, which is attributable to the presence of the disorders before mentioned.

95. The following table brings out many interesting facts regarding the condition of the flock as at present constituted :—

Rams.				Ewes.			
No.	Age.	Average Weight.	Average Yield of Wool.	No.	Age.	Average Weight.	Average Yield of Wool.
38	Lambs	28 lbs.	Not shorn.	27	Lambs	25·6 lbs.	Not shorn.
31	Shearling ..	47 ,,	1·76lbs.	34	Shearling ..	39·6 ,,	1·6 lbs.
16	2 Shear	66 ,,	2·28 ,,	23	2 Shear	48 ,,	1·77 ,,
8	3 Shear	69·13 ,,	2·25 ,,	6	3 Shear	48·3 ,,	1·58 ,,
15	Aged	69·7 ,,	1·78 ,,	·78	Aged	53·55 ,,	1·29 ,,
70	Average	58·74 ,,	1·94 ,,	141	Average	49·05 ,,	1·45 ,,
			Average of 211 sheep of all ages ..			52·27 lbs.	1·62lbs.

96. These figures show that the rams, excluding this year's lambs, averaged in weight 9·69 lbs., or 16·5 per cent. more than the ewes ; the greatest difference in weight being in the shearlings, where the rams are as much as 37 per cent. heavier. It also shows that up to the age of 2 years the sheep increase considerably in weight, but that after that age there is very little material alteration.

97. As might be expected, seeing that early development is generally the most rapid, there is a greater difference between the weights of the shearlings and the lambs than between that of the sheep of any other two consecutive years ; in this case the shearling rams are 68, and the shearling ewes 55 per cent. heavier than the ram and ewe lambs respectively, whilst the 2 shear are only 40 per cent. heavier than the shearling and $4\frac{1}{2}$ per cent. lighter than the 3 shear rams, and the 3 shear ewes are almost the same weight as the 2 shear, and the latter only 21 per cent. heavier than the shearlings. These facts only show how necessary it is to give strong nourishing food to sheep under 2 years of age, if it is desired to obtain well-formed and well-grown stock.

Quality of wool improved.

98. The wool produced this year shows on the whole an improvement in quality, and the sheep are far better covered, there being an absence of the bare necks and breasts that were formerly so common. The value of the wool in the local market has increased considerably, for instead of only $1\frac{1}{2}$ Annas per pound, the rate obtained in 1871, this year $2\frac{1}{2}$ Annas were realized, showing an increased value of 66 per cent. The amount of yield per sheep does not average quite as high as a clip did in 1871, when 120 sheep averaged 1·81 lb. ; this is probably due in a great measure to the scarcity of grass with which this season has been characterized, whilst the number shorn is in this case nearly double.

Yield for weight good.

99. Returning again to the table given in paragraph 95, it will be seen that for every 10 lbs. of live weight, the sheep produced on an average 4·95 ounces of wool, an amount which compares not unfavorably with that yielded by the English short-woolled breeds of sheep. In the following table the yield of wool per 10 lbs. live weight of the different sexes at various ages is given :—

—	Shearlings.	2 Shear.	3 Shear.	Aged.	Average.
	oz.	oz.	oz.	oz.	oz.
Rams	5·99	5·53	5·21	4·09	5·28
Ewes	6·46	5·90	5·23	3·85	4·73

100. This table shows that of the whole flock the shearlings clip heaviest for their weight ; and that as the sheep develope, the yield of wool does not increase in propor-

tion to their size. The greatest yield of wool is apparently given at the age of 2 years, increasing up to that age, and remaining stationary or lessening after, both in the case of the rams and of the ewes.

101. *Poultry.*—The fowls and ducks, referred to in paragraphs 49 and 50 of the last report, have had in general perfect health, but amongst the chickens and ducklings there has been a great mortality. The Pekin ducks after laying almost continuously for nearly six months ceased, and have not again commenced to lay to any extent, the extreme heat having apparently been too great for them, as they have never recovered, although their general health has been good.

102. The following poultry and eggs have been sent to different parts of the Presidency during the year :—

—	Poultry.	Eggs.
Brahma Dorking	48	146
Half-bred Fowls	25	146
Ducks	9	19
Total ..	82	311

103. The poultry yard was rearranged, extended, laid down in turf, and planted with shade trees; these arrangements will conduce greatly to the health of imported fowls as well as young chickens, the temperature of the yards being much lower and the poultry protected from the sun.

SECTION III-B.

FOODS AND FEEDING.

104. *Feeding.*—In selecting food for any kind of stock, the following points must be borne in mind; the species and age of the animal to be fed, and the object with which it is being fed.

Conditions and objects must be known.

105. Thus, the ox can digest more woody fibre in a food than the sheep, whilst the pig seems incapable of digesting it at all; cattle from the size of their stomachs require a bulky food, and a considerable amount of water; sheep, on the contrary, do not require so large an amount of food, nor do they require so much water, in proportion to their size.

106. The pig has been proved to make the most use of his food in assimilating it into his structure, and thus fattens easily and quickly, and repays the use of rich foods.

107. If animals are young and in a growing state, they require a larger and more concentrated supply of food for their size than older animals. They require a more highly nitrogenized food for the development of their tissues; and they extract from it a larger amount of its mineral constituents for the formation of their bones, &c.

108. In fattening cattle and sheep, when the wear and tear is reduced to a minimum, and the object is to increase the amount of flesh and fat, substances rich in oil, starch, gum, sugar, &c., produce the best results.

109. Milch cattle should always be liberally fed with green fodder, as it causes an increase in the quantity of the milk produced. If the production of butter be the object in view, the use of foods containing a high percentage of oily matters has an effect in increasing the amount. Should cheese be the desideratum, the use of leguminous crops, such as gram, owing to the fact that cheese is chiefly composed of casein (the nitrogenous part of milk), will cause an increase of the constituent required.

Green fodder good for milch cows.

FOODS.

110. *Chaffing.*—The practice of chaffing fodder for cattle has been regularly practised here with the best results. It is a most economical arrangement in preventing waste, which always occurs when cattle are fed on long straw. It enables cattle to be kept in good condition on a smaller allowance of food, as they do not tread into manure any appreciable amount of chaff, and also as their food is in a finer state of division, the cattle are able to assimilate more of what they eat.

Chaffing most beneficial.

111. *Ground-nut Cake*—is still the auxiliary food used; and although, as has been the case with all other food stuffs, there has been a very great rise in the price of it, it still remains the cheapest food procurable. In 1870, this cake was obtainable at the price of about 90 lbs. per rupee, at the commencement of the present year, the rate paid for it was about one rupee for 73 lbs., or an increase in price of nearly 19 per cent.; this may be attributed to the increased demand of the cake for export. The contractor who was supplying the cake, failed to fulfil his contract after December, and since then cake has been obtained in the open bazaars at an average price of about one rupee for 45 lbs.

Great rise in price.

112. The value of the cake as a feeding stuff has already been clearly shown, and the longer it is used the more valuable does it prove. The following analyses of the oil-cake made from the ground-nut are interesting:—

Most valuable feeding stuff.

Constituents.	Professor Church.		Professor Tuson.*		Dr. Vœlcker.	Dr. Anderson.	Average Composition of Linseed Cake.
	Decorticated.	Undecorticated.	Decorticated.	Undecorticated.		Average of two.	
Moisture	9·3	8·1	9·58	9·28	10·80	10·84	12·0
Oil	5·6	8·8	7·40	6·99	8·12	9·80	11·5
Albuminoids	43·4	30·5	42·81	32·81	28·62	30·33	29·7
Carbo-hydrates	31·4	27·8	27·63	23·67	18·86	45·50	27·8
Indigestible fibre ..	5·2	19·1	7·87	23·80	29·09		12·0
Ash	5·2	5·7	4·71	3·45	* 4·51	† 3·53	‡ 7·0

* Containing sand 1·4. † Containing phosphates 1·15, phosphoric acid ·80.
‡ Containing potash 1·65, phosphate of lime 4·92.

113. Judging from the analyses, given by Professors Church and Tuson, of cakes made when the seed is husked and unhusked, those of Dr. Vœlcker and Dr. Anderson referred to samples of undecorticated cake. Comparing the analyses with that of a sample of linseed oil-cake given by Dr. Vœlcker, the cake will be seen to be not quite so rich in oil and therefore not so well adapted for fattening purposes, but, as the means of expressing the oil from the seed in this country are very inadequate, in all probability the percentage of oil is much higher, so that this objection disappears; the high percentage of nitrogenous matters explains why it is so useful a food for working cattle.

114. Further it may be observed that the high percentage of nitrogenous compounds in the cake causes great increase in the value of the manure made by animals fed on it; for it is calculated by the best authority on the subject, Mr. J. B. Lawes, of Rothamstead, that the loss of nitrogen in the consumption of cake is about one-tenth of that which it contains, the rest passing off in the manure.

Cake fed increases the value of manure.

115. The ground-nut cake met with here is always decorticated; the husks are used as fuel, and the ashes therefrom, which amount to ·7 per cent. of the total crop, are generally thrown away; which, as the following extract shows, is a most wasteful practice:—

"The ash of the seed consists of salts wholly soluble in water, they being phosphates of the alkalies, with traces of alkaline chlorides and sulphates. The phosphoric acid is chiefly united with potassa. The ash of the husk differs in containing chiefly common salt, and phosphates of lime and magnesia."

Marseilles cake.

SECTION IV.

IMPLEMENTS, MACHINES AND TOOLS.

116. *Swedish Ploughs.*—It was stated, in paragraph 191 of last year's report, that arrangements had been made to obtain some specimens of iron ploughs of Swedish manufacture; early in March, 28 specimens of 14 different descriptions of ploughs were received.

All swing ploughs.

117. In construction and in form, excepting Nos. 9 and 29, they present no very marked peculiarities; all of the ploughs are swing ploughs, and as such are open to the objection, common to such implements, of being difficult to manage. This defect can be however easily remedied, and, in the trials the ploughs were subjected to, a wheel was fitted on all.

Cheap implements.

118. The cost-price of these ploughs delivered at Madras averaged about Rs. 33, which, considering the substantial manner in which they are put together, is very moderate.

119. All the ploughs are made either of wrought iron, cast iron, or steel in their different parts. The stilts and beams are in all cases made of wrought iron; Nos. 1, 2, 12, 16, 37 and 38, have trussed, the others simple beams. Excepting in the case of Nos. 29 and 34 the bodies are made of cast iron, whilst in the two ploughs referred to wrought iron is used. The slades are in every case cast, whilst the shares are all wrought iron. Steel mould-boards are fitted to Nos. 27, 29, 30, 34, 37, 38, 39, and 40, and those of the rest are cast iron.

120. In No. 9 a plan, which is totally inapplicable to the construction of machines for this country, and of doubtful economy anywhere, is adopted; the body, slade, and mould-board, are cast in one piece, thus increasing the risk of breakage, and the cost of repair if an accident occurred; to this method of construction, the general objections to castings, urged in the report for the year 1874-75, paragraph 135, are particularly applicable.

121. No. 29 is a very small plough; exceedingly light and short, tolerably efficient, but its peculiarity lies in one stilt being dispensed with, the solitary one, however, is fitted at the top with a cross-piece on which two handles are fixed.

122. In the following table the results of a trial of the ploughs, has swing ploughs, are given :—

Plough.	Furrow.			Draught.	Comparative Efficiency.	Weight without Wheel.
	Average.		Cubic Yards of Soil moved in 144 yards run.			
	Depth.	Width.				
	INCHES.	INCHES.	C. YARDS.	LBS.		LBS.
Ransome's	4	10	4·4	175	100	88
No. 30	4·5	14·75	7·375	315	92·18	147
,, 34	5·25	10·25	5·98	259	90·91	79
,, 39	5·00	12·00	6·6	322	81·52	126
,, 37	4·875	13·5	7·31	385	74·78	156
,, 27	4·5	12·25	6·125	343	70·31	126
,, 9	4·31	12·75	6·11	343	70·14	126
,, 3	6·00	11·00	7·3	420	68·75	133
,, 29	4·5	9·75	4·875	280	68·55	71
,, 40	5·0	10·75	5·97	343	68·53	126
,, 38	4·81	10·75	5·74	392	57·66	150
,, 2	4·81	10·75	5·74	392	57·66	167
,, 12	4·25	13·25	6·26	434	56·79	223
,, 16	4·125	12·5	5·74	420	53·81	185
,, 1	3·75	10·00	4·16	333	49·27	173
Average of 14 Swedish Ploughs	..	..	6·099	355·8	67·49	142

123. The Ransome's plough referred to in the table was not a swing plough so that the comparison is not complete, but still the excessive draught for work done is very clear, and when this is considered in addition to the difficulties of managing a swing plough, it is evident that as such the Swedish ploughs on the whole are not to be compared with the wheel ploughs of the English make.

124. To see whether if fitted with a wheel these ploughs would be found to have any comparative merits, the trials, of which the following are the results, were made :—

Plough.	Furrow. Average. Depth.	Furrow. Average. Width.	Furrow. Cubic Yards of Soil moved in 144 yards run.	Draught.	Comparative Efficiency.	Weight with Wheel.
	INCHES.	INCHES.	C. YARDS.	LBS.		LBS.
Ransome's	3·75	9	3·75	175	100	88
No. 39	4·5	11·875	5·9375	273	101·49	137
,, 29	4·5	11·5	5·75	273	98·29	82
,, 40	4·5625	11·125	5·64	273	96·41	137
,, 27	3·8125	10·75	4·55	224	94·79	137
,, 3	4·625	9·125	4·69	231	94·74	144
,, 12	4·4375	11·625	5·757	294	91·38	234
,, 34	4·0000	10·125	4·5	231	90·91	90
,, 37	4·125	12·5	5·729	329	81·26	167
,, 2	4·0000	10·75	4·7	294	75·84	178
,, 1	4·3125	11·125	5·33	336	74·03	184
,, 9	4·4375	7·875	3·88	245	73·80	137
,, 30	4·0625	10·75	4·85	329	68·79	158
,, 38	4·0625	10·625	4·525	315	67·00	161
,, 16	4·5	10·5	5·25	378	64·82	196
Average of 14 Swedish Ploughs	..	..	5·0833	287·5	82·515	153

Although, because the two sets of trials were performed at different dates and in different fields, and that during the period which elapsed between them the land had become considerably drier, the outturn of work for draught on the two occasions cannot be fairly compared, yet, seeing that the same Ransome's plough was tested in both cases, it is fair to conclude that a proportionate increase of draught for work done would take place in all the ploughs, owing to the different conditions under which the two trials are conducted. The Ransome's plough whilst registering the same draught in both cases, on the second occasion moved 15·60 per cent. less soil in a given distance.

A wheel effects the draught to a great degree.

125. Bearing the above-mentioned fact in mind, the decrease in draught, shown in the trials after a wheel had been added, must be attributed solely to that addition ; the average decrease of draught in the ploughs is 68·3 lbs., or 19·2 per cent., and from this the usefulness of a wheel may be easily judged

126. The effect, however, that the wheel had in lessening the draught varied very much in every case, and there were two remarkable exceptions to the rule, viz., Nos. 30 and 34; the former displayed less than and the latter the same efficiency as compared with Ransome's plough when used as swing ploughs, showing clearly that these two implements can be used comparatively advantageously as such. The effect of the wheel in Nos. 9, 16, 37, 38 was very small, but still sufficient to recommend the addition.

For land similar to that of trials heavy ploughs not suited.

127. These trials have shown very clearly that, for such work as they were doing at the time of trial, the lighter ploughs were far more effective, both when fitted with wheels and when used as swing ploughs; this may be partially accounted for by the fact that, draught equal to about three-fourths of the gross weight of a plough is consumed in moving it when it is doing no work, and also because the heavier, that is larger, ploughs are better adapted to deeper work, or for ploughing stiffer soils than those on which they were tested. The following table shows the points referred to:—

—	Without a Wheel.		With a Wheel.	
	Seven lightest.	Seven heaviest.	Seven lightest.	Seven heaviest.
Average gross weight	112 lbs.	172 lbs.	123 lbs.	183 lbs.
Average soil moved in 144 yards run	6·15 c. yds.	6·05 c. yds.	4·99 c. yds.	6·17 c. yds.
Average draught	330 lbs.	382 lbs.	250 lbs.	325 lbs.
Comparative efficiency	100	85	100	80
Comparative efficiency deducting from draught ¾ of gross weight.	100	95	100	86

128. Another point has been shown by this experiment, that is, that the friction on a steel or cast-iron mould-board does not differ sufficiently to form an item in the draught; the extra weight, however, of the cast-iron mould-board is objectionable, and the following table demonstrated the facts referred to very clearly:—

—	With a Wheel.		Without a Wheel.	
	Eight Ploughs.	Six Ploughs.	Eight Ploughs.	Six Ploughs.
	Mould-board, steel.	Mould-board, cast-iron.	Mould-board, steel.	Mould-board, cast-iron.
Average gross weight	123 lbs.	168 lbs.	134 lbs.	179 lbs.
Average draught	330 lbs.	360 lbs.	281 lbs.	296 lbs.
Average soil moved	6·25 c. yds.	6·56 c. yds.	5·925 c. yds.	4·947 c. yds.
Comparative efficiency	100	96·24	100	79·26
Comparative efficiency deducting from draught ¾ of gross weight.	100	106·74	100	93·24

129. *Water-lifts.*—No new machines have been experimented with during the year. The double mhote, so often referred to in these reports, continues to give most satisfactory results. The chain-pump, referred to in paragraph 184 of the last report, has also worked with fair results, but the expense of repairs on it is very great.

SECTION V.

DISTRIBUTION OF SEEDS.

130. During the past year the following seeds have been distributed to the districts mentioned in the following table:—

—	Maize.	Sorghum Saccharatum.	Planter's Friend.	Yellow Cholum.	Carolina Paddy.	N. O. Cotton-seed.	Egyptian Cotton-seed.	Tobacco-seed.	Jute-seed.	Wheat.	Corcapilly-seed.	Sundries.
	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	OZ.	LBS.	LBS.	LBS.	
Ganjam	50	50	50	..	..	..	..	..	..	..	..	..
Vizagapatam	5	15	55	..	..	..	..	..	10	..	..	..
Godavery	30	30	20	..	..	..	..	7 oz.	..	..	..	..
Kistna	20	20	20	..	..	..	..	..	..	..	..	..
Nellore	..	100	23	..	..	25	..	..	..	..	..	..
Cuddapah	50	..	..	..	..	..	..	..	..	..	..	..
Kurnool	20	..	..	..	..	..	..	..	..	..	..	..
Bellary	10	100	100	..	..	..	..	..	..	..	..	..
North Arcot	20	20	20	..	..	..	..	1 oz.	..	..	..	..
Madras	..	90	45	..	..	50	10	..	..	..	..	..
Chingleput	87	15	5	..	235	10	..	..	..	10	..	..
South Arcot	50	25	..	..	..	100	..	..	..	..	..	..
Salem	80	72	30	..	..	..	..	..	..	..	..	..
Coimbatore	5	..	..	..	..	..	..	6 oz.	..	..	..	..
Trichinopoly	65	5	5	5	..	..	..	4 oz.	..	..	..	..
Madura	5	25	10	..	..	5	..	11 oz.	..	..	5	..
Tanjore	5	¾	½	..	..	..	..	..	..	..	..	..
Tinnevelly	15	80	70	..	95	20	..	..	..	..	..	..
Malabar	100	65	80	..	..	½	½	..	..	..	..	..
South Canara	53	10	5	10	..	..	..	..	..	..	..	..
Nilgiris	..	100	50	..	..	..	..	..	..	..	..	27 packets.
Mysore	..	10	10	..	..	..	..	..	..	..	..	2 do.
Travancore	16	20	35	..	5	10	..	..	..	..	..	..
Bombay	10	10	..	..	..	100	..	.	..	..	..	..
Rajputana	4	..	..	..	..	..	..	..	..	..	..	9 packets.
Total ..	700	862¾	633½	15	335	320½	10¼	1 lb. 13 oz.	10	10	5	38 packets.

131. The tobacco-seed referred to was imported, under the orders of the Board of Revenue, from Australia; but very few applications, as will be seen, were made for it.

SECTION VI.

IMPLEMENT WORKSHOPS.

132. During the past year, besides the implements mentioned in the accompanying table being manufactured for sale, a large amount of repairs of tools, &c., for the farm, the furniture for the School of Agriculture, and various models of water-lifts, &c., for distribution were made:—

Districts to which sent.	Iron Ploughs.	American Ploughs.	Combined Ploughs.	Jointed Harrow.	Drill Sowing Machine.	Planters' Hoes.	Reaping Knives.	Winnowing Machine.	Chaff Cutter.
Coimbatore	..	1	..	..	..	..	..	..	..
Mysore	8	3	3	..	..	..	..	..	..
Tinnevelly	1	1	..	1	1	12	12	1	1
Coorg	..	1	1	..	..	..	..	..	..
Bellary	..	..	..	..	..	..	..	..	1
Nilgiris	..	..	..	..	..	..	..	..	1
Madras	..	2	..	..	..	..	..	..	..
Total ..	9	8	4	1	1	12	12	1	3

133. A plough very similar to the American one, referred to in paragraph 138 of the report for the year 1874-75, has been made in the shops, costing about Rupees 20; several modifications, of the model imported from America, materially affecting the efficiency of the plough, were made. It is the American plough referred to in the table given in the preceding paragraph.

134. The following is a statement of the transactions of the shops during the year:—

Expenditure.	RS. A. P.	Income.	RS. A. P.
Plant	2 11 0	Machines	915 13 0
Labor, &c. ..	1,066 10 8	Materials, labor, &c.	1,423 14 2
Materials, &c. ..	877 2 4		
Total ..	1,946 8 0	Total ..	2,339 11 2

135. The next statement shows the financial condition of the shops. It will be seen that the deficiency, since their commencement in 1871, has been slightly reduced during the year; the reduction would have been greater had the plan formerly pursued, of calculating the valuation of the plant, been adopted, instead of taking the actual valuation.

Balance Sheet of Implement Workshops on 31st March 1877.

Liabilities.		RS. A. P.	RS. A. P.	Assets.	RS. A. P.	RS. A. P.
Capital—				Valuation—		
Advanced 1870-71		883 1 5		Buildings	419 15 3	
Do. 1871-72		213 1 2		Plant	243 5 0	
Do. 1872-73		1,077 3 2		Materials	51 6 0	
Do. 1875-76		219 4 11		Implements for sale ..	283 0 0	
		2,392 10 8				997 10 3
Repaid—	RS. A. P.					
1873-74 ..	213 10 5			Outstanding bills	..	306 2 3
1874-75 ..	122 15 9			Deficiency	..	514 15 2
1876-77 ..	393 3 2					
		729 13 4				
			1,662 13 4			
Outstanding bills		..	155 14 4			
Total ..		..	1,818 11 8	Total ..	..	1,818 11 8

SECTION VII.

ESTATE.

Area.

136. The area of the farm estate remains unchanged, for, although the new site for the Commissariat Slaughter-houses was given over, when funds were found to be unavailable for carrying out their much-to-be-desired removal, it was retransferred.

Trespass nuisance.

137. The removal of the wudder village has lessened the trespass we suffer from, but until the slaughter-houses are removed, and Roshunbaughum village is fenced or walled in in a manner that will prevent it, the nuisance must continue to be very great.

Satisfactory experiments will be possible in the future.

138. The many difficulties in the way of carrying out experiments in a satisfactory manner are rapidly disappearing, now that the requisite estate improvements are nearly completed; and as soon as the whole land within the boundaries of the farm is given over to it,

and trespass can be prevented, they will be removed. Now that so much of the land has been levelled to a moderate slope, the detrimental influences of an excess of water, either running or stagnant, will be removed; the effects of manuring will be more permanent and marked, and the desired evenness of quality of soil will, it is hoped, be obtained.

PERMANENT IMPROVEMENTS.

The estate improvements carried out during the year, under the superintendence of Mr. Schiffmayer, comprise, amongst others, the re-arrangement and extension of the farm buildings, including a duck-house for the reception and acclimatization of exotic breeds, a new sheep-shed, an extension of the barn to form a cake-room, and several minor works; a large area of land being levelled and arranged in such a manner as to admit of the existing wells and channels being utilized; the extension and deepening of the irrigation channel, referred to in paragraph 26 of the report for the year 1872-73; the excavation of a new channel on the western side of the farm to bring the water from the Adyar to the central portions of it where it will be raised for irrigation purposes; laying out and partially completing a new main drive running through the farm from east to west, and building a lodge at the western entrance gate; laying out a portion of the experimental botanical grounds for the Agricultural College; planting several acres of the poorer soils with casuarina and other trees; and working the tile-yard, where a number of bricks for the new buildings, drain-pipes, and other articles were manufactured.

Buildings.

Levellings.

Irrigation Channel.

Road.

Planting.

Tile-yard.

(Signed) CHARLES BENSON, M.R.A.C.,
Superintendent of Sydapet Farm.

SYDAPET,
August 27th, 1877.

WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

THE AGRICULTURAL COLLEGE.

In my last Annual Report, I noticed briefly, this new institution. It seems desirable that a fuller account of the circumstances that have led to its establishment should be placed on record.

Sydapet Farm Apprentices.

2. Almost from the time the Sydapet Experimental Farm was first opened, it had attached to it a number of Apprenticeships, which were filled by Eurasian and Hindu youths. Up to 1871 there was only one class of these Apprentices. These youths were afforded only such training as could be had from taking part in the ordinary operations of the farm. Each Apprentice began on a monthly salary of Rupees 15, which was increased annually, on good conduct, until Rupees 25 per mensem was reached. All were provided with free quarters. In 1871, it having been determined to start a number of District Farms, another class of Apprentices was established, in view to provide Superintendents for these new farms. To these Apprenticeships liberal salaries (Rupees 40 each per mensem) were attached, in order to induce young men of good social position to offer themselves for training. The class was filled, but not with men of the stamp it was hoped to obtain; indeed, all the inducements offered failed in securing anything like a competition for the apprenticeships and only two or three were filled by men of a fairly good social position, while none of those appointed were educated men. This class was filled by Hindus and Mahomedans. The training to which these youths were to be subjected was similar to that of the youths in the other class.

District Farm Apprentice Class.

Unsatisfactory conditions under which placed.

3. References were frequently made in my Annual Reports, to the very unfavorable conditions under which these youths were placed for gaining a knowledge of agriculture. The progress made by one or two of the youths was certainly fair, bearing in mind the difficulties they had to contend with, but the general results were unsatisfactory; the means employed were clearly quite inadequate for training men to fill the posts of District Farm Superintendents. On this subject, in a letter, No. 414, of the 28th of May 1872, I addressed the Board of Revenue as follows:—

"The arrangements for training and educating Farm Apprentices need much fuller consideration. If we are to turn out really competent Superintendents, men who will be able to train youths on the local farms, and who will be worth to Government from 150 to 250 Rupees per mensem, it is evident that we must go about our work in a *very thorough and systematic* manner, or the three years allotted for training, &c., will not nearly suffice. It is of the utmost importance that *we should now* come to a clear and definite understanding, as to the course to be pursued in training these apprentices. Fortunately, agricultural training is no new experiment; we have before us the results of many years' experience, in the training of agricultural pupils in America, on the Continent of Europe and in Great Britain and Ireland. It is true that the social habits of the people of this country are altogether different to the habits of the people in any of the countries I have named, while their agricultural practice is equally peculiar, rendering it necessary that our work, to a certain extent, should be experimental; still there is much in the experiences of other countries that may serve, to warn us as to the dangers to be avoided, and indicate the general direction towards which our endeavours should tend. The system under which agricul-

tural pupils are trained in Ireland is, I believe, the most suitable for such a country as this, peopled with poor cultivators holding very small areas of land. This system undoubtedly has its faults, but these are unimportant in comparison with the vast benefits it confers. Under the Irish system, agricultural schools, of different grades, with small farms attached, are equally distributed over the country; in the schools the pupils receive a good literary and agricultural education. These schools are the feeders of the central institution, to which the best pupils, after qualifying, are sent to complete their agricultural training, at the entire expense of Government. These pupils become the Superintendents of the local farms and agricultural schools, farmers, stewards and bailiffs, and thus sound agricultural knowledge is gradually extended over the country.

"In the Madras Presidency this system would work admirably. A central farm, with branch local farms, already forms part of our scheme. The apprenticeships of 40 Rupees each per mensem, to be created for each projected farm, might be turned into scholarships, to be awarded to the most competent pupils, after a sufficient time had elapsed to admit of their progress being determined, all students thus entering at a uniform allowance of 15 Rupees a month under the terms of G.O., No. 1,041, dated 13th June 1871. The students to be either Natives or East Indians, and all to undergo an entrance examination, to be similar to that for admission into the Engineering College, or the subordinate ranks of the Medical Department. The course of training to extend over three years, during which time the pupil should receive a thorough practical training in the field, and a theoretical training in the lecture-room; lectures on agriculture, agricultural chemistry, botany, mechanics, veterinary surgery, &c., being delivered at stated periods; while periodical examinations should be held, in order that the progress of the pupils may be ascertained."

These proposals did not meet with the approval of the Board, or Government.

4. In my report for the year ending 31st of March 1873, I wrote as follows regarding these apprentices:—

"The general conduct of these young men while at the farm has been satisfactory, and they evince some interest in their duties, especially in those of a practical kind; all are able to work our English ploughs; indeed, two or three can plough very well. But the system is certainly not one that is calculated to train Superintendents to be placed in charge of the district farms. These young men come here ignorant of the very ABC of agriculture, and agriculture can be taught only in the way that any other profession is taught, that is, by beginning with systematic elementary instruction, and grounding the student thoroughly as he proceeds in his education. The system under which these young men are supposed to be taught agriculture is, it is true, that under which many agricultural pupils are placed in England; but little consideration is needed to enable one to see that such a system, even if beneficial in England, can be so, only under conditions *which are not met with in this country*. In England, young men who are placed for a time with a farmer to learn practical farming, frequently spend a year or more at some institution devoted to the teaching of agriculture or the sciences bearing on agriculture; and the superior practice which they are taught is no novelty. * * * * Some of these young men may in time, under the training under which they are now placed, become suited for employment as Overseers under certain conditions, and they might also under certain conditions make successful farmers, but they can never become what the District Farm Superintendents should be—local sources of agricultural information, local authorities on all relating to the agricultural practice of their districts, and the pioneers of agricultural reform."

5. In June of the same year in which the foregoing remarks were penned, the Board of Revenue were led to make more minute inquiries, as to the working of the system under which the apprentices were placed for training. The results of those inquiries are embodied in a letter, they addressed to Government, from which the following extracts are taken:—

"In their Order of the 7th April 1873, No. 397, Government agreed with the Board that the establishment of a system of agricultural education at the Sydapet Farm should be deferred as premature, but ordered that the arrangements already sanctioned should be made complete and effectual, *i.e.*, that the Sydapet Farm should be made as useful to the public as possible, and that District Experimental Farms should be instituted and provided with competent superintendents.

"In devising means for carrying out these orders, the Board have been led to make minute inquiries as to the methods pursued at the Government Farm, as to the facilities for training Farm Superintendents there, and as to the manner in which the information possessed by Mr. Robertson and his subordinates can best be disseminated. One result is that the Board's opinion, that the commencement of systematic instruction in agriculture and the sciences bearing

upon it could be and should be deferred, has completely changed. I am accordingly directed to solicit Government to reconsider the question.

"The reasons which have influenced the Board may be briefly summarised as follows:—

"(1.) That unless systematic instruction in agriculture and the sciences bearing on it is given at the Sydapet Farm, competent Superintendents for the Experimental Farms which are to be instituted cannot be trained there.

"(2.) That, without Superintendents trained in this way, the Experimental Farms will be of little or no use.

"(3.) That the means for giving such a training, the lectures, the students, the opportunities for practising what is taught, and the funds are all available.

"(4.) That the good effects of the instruction will not be limited to a few Superintendents of Government Farms, but will slowly leaven the agriculture of the whole country, as in England, America, France, and Germany.

"(5.) That as a scene of systematic instruction open to all comers, the Sydapet Farm will be infinitely more useful to the public than it is at present.

"It is easy to show that the present system of teaching Apprentices how to plough and sow and manure, &c., will not supply competent Farm Superintendents. There are two classes of Apprentices in the Sydapet Farm. One class, six in number, was formed under G.O., dated 13th June 1871, No. 1,041. They are appointed after an examination which shows that they are fairly educated, and they are paid salaries beginning at Rupees 15, and increasing in four years to Rupees 25. The class is meant to supply Overseers and subordinates, and will do this, but nothing more. The other class consists of the six District Apprentices chosen by Collectors under G.O., dated 22nd September 1871, No. 1,657, and Government now propose to raise the number from six to ten. They are paid Rupees 40, but even this high salary has not been sufficient to attract the right sort of men. It is intended that they should be superior in station to the other class and supply Farm Superintendents; but the Board are assured that there is not one of them who seems at all likely to become fit for such an employment.

"The present system must be admitted, therefore, to be unsuccessful in practice. In theory it *must* be unsuccessful; for no one, who is without an agricultural education and some knowledge of chemistry, botany, animal pathology, &c., however skilled he may be in the manipulations of the farm, will be able to vary its processes so as to adapt them to a different climate, a different soil, different crops, different breeds of cattle, and different agricultural conditions. A man who is a skilful farmer in Madras would find himself at a loss even in ordinary farming if he were suddenly placed in Bellary. The scientific principles which underlie and suggest the processes of the farm are the same everywhere, but the processes themselves change.

"But even, if by extraordinary ability a Superintendent of a Government Farm knowing nothing of scientific principles were to succeed in cultivating the farm, he would be unable to give a sensible reason *why* when he worked in a different way from his neighbors.

"It is found necessary to conduct youths who intend to be Engineers and Public Works Overseers or Doctors and Hospital Assistants through a stated curriculum, and the same thing must be done with men who are to exemplify and teach scientific agriculture. The students must go through courses of lectures in agriculture, in elementary chemistry, in agricultural chemistry, in animal pathology, and veterinary medicine, and in botany; they must verify the lessons thus taught them on the soil itself and on cattle, and they must have a fair general education to begin with.

"The Board have been in communication with the Principal of the Medical College, and are confident that lecturers, who will deliver lectures once a week on elementary chemistry, animal pathology, and veterinary medicine, and botany, can be obtained thence. The possession of a fair education can be tested by an entrance examination and supplemented by instruction in book-keeping, surveying, mensuration, &c., without difficulty.

"The expenditure on instruction thus incurred can be paid from the Surplus Pound Fund without interfering with the establishment of the experimental farms.

"The stipend of Rupees 40 granted to the District Apprentices is needlessly large, and the two classes should be on the same footing, their salaries increasing from Rupees 15 to Rupees 25, and Rupees 5 being allowed as batta to Apprentices who come from a distance. The number may then be increased, the increments of salary regulated by examination, and scholarships and prizes established without additional cost.

"The machinery thus provided will suffice not only for turning Apprentices into Overseers and Farm Superintendents, but for training a large number of private students, and if private

students are allowed to attend, the opportunities of selecting competent men for the service of the State will be greatly increased.

"For some time to come, for obvious reasons, the supervision should be left to the Board and not entrusted to the Educational Department. This is in accordance with the practice of several of the States of Germany where the Agricultural Colleges are under the Minister of Agriculture, and of America where the Board believe that agricultural education is supervised by the Commissioner of Agriculture.

6. In order that the matter might be laid fully before Government, I was directed to submit my views to the Board on the whole question of agricultural education. This I did, in a letter, dated the 14th of October 1873; from this letter the extracts that follow are taken:—

"The time seems now to have arrived for a commencement to be made in this Presidency in systematic agricultural education. Our literary institutions are turning out annually large numbers of fairly-educated young men, many of whom have a very uncertain future before them, and amongst these we might expect to find no inconsiderable number who naturally belong to agriculture, and who would readily undergo a systematic agricultural training. In this way an Agricultural College *would aid in restoring the balance* which the undue facilities for obtaining a mere literary education, have so greatly disturbed. At present our schools and colleges *are drawing from agriculture the best of her men;* if this is allowed to continue, our degraded husbandry will only become the more degraded. We have established a Medical and an Engineering College, neither of which can possibly confer on the country a tithe of the benefits that would result from the existence of a well-organised, well-supported Agricultural College.

"We have wasted much time, and large sums of money, in the hap-hazard, unsystematic way in which we have endeavoured to bring about some improvement in the husbandry of the people. We cannot longer continue to deal with our agriculture in the way we have dealt with it heretofore; surely the enormous mass of evidence now available amongst the records of the Government of this Presidency, regarding the results which have attended the spasmodic and very unsystematic efforts to effect some improvement in native farming, is sufficiently convincing, and this evidence is conclusive, as to the unsatisfactory character of the results. And, such being the case, it is abundantly evident that we must either retire altogether from all active exertions, on behalf of the improvement of our husbandry, or we must apply our efforts in some other direction and in a way somewhat different.

"It is admitted in all civilised countries that, while the ownership of land confers rights and privileges, it also creates duties, and not the least of these is a responsible stewardship on behalf of the people, their interests being effected for good or for evil through a fall or a rise in the prices of the necessities of life, as the duties arising out of this trust are well or are ill-performed. Now, in this Presidency the duties created by the ownership of land naturally devolve on Government, as in most districts Government is the chief land-owner; though undoubtedly these duties and responsibilities should be shared in by the other owners of land, whose position will most certainly be bettered by any well-organised, well-directed effort to promote our agriculture. But, if this view of our responsibility is not deemed to be sufficiently weighty to justify Government in at once inaugurating a complete and efficient system of agricultural instruction, surely, *self-interest* will be a sufficient reason. It is not too much to say that, if sound agricultural knowledge was diffused over the country, *famines would be less frequent and less severe in their character;* that there would be less need for the frequent large annual remissions of rent; that the vast capital sunk in railways, canals, irrigation works, &c., would bring in more remunerative returns, while we would not have large areas of land abandoned as has recently been witnessed in different parts of India, because the irrigation means provided by the Engineer are *too complete* for an easy-going agriculture.

"I have no desire to advocate the merits of the educational scheme at the expense of the merits of the farm scheme; there is nothing of an opposing character in the two schemes. It seems to me that, in the true order of development, the farm scheme would naturally arise out of the educational scheme. I am very strongly of the opinion that, in the present state of our rural affairs, an institution, such as the Board desire to see established, will produce results of far greater importance than those that could possibly arise from the working of District Farms, with such inefficient means as we can now only command, while, in the first outlay and in the annual working charges, such an institution would be much less costly, than the farms it was proposed to commence at once, in four districts of this Presidency. Even, if we could command the means to admit of these farms being worked in a really efficient way, I do not think that they would be of great use as mere example farms, in the present state of education amongst our rural population. The fact is, example farms belong to a higher stage in agricultural improvement than has yet been reached in this country. Example farming will undoubtedly now do some good,

examinations should be held, in order that the progress made by the members of this class may be ascertained.

"The lectures to be delivered during the College course of two years should, I think, be on Agriculture, Agricultural Chemistry, Vegetable Physiology, and Agricultural Botany, Animal Physiology, and the pathology and treatment of the diseases of the animals of the farm, Practical Geology, &c. In addition to lectures there should be conversation classes on the subjects of the lectures, occasional field classes, and a select laboratory class. * * * * * Europeans, East Indians, and Natives should alike be eligible for admission into the institution. No fee of any sort should be charged until the institution has been some time in existence, but every student should be compelled to provide for himself the text-books, &c., required in his class.

"It appears to me that there should be three divisions in which to class those who wish to undergo instruction in the institution—a division (1) for those whose stipends will be paid by Government; another (2) for private students and students who will be supported by the nobility and wealthy land-owners of the Presidency; and a third (3) for those persons who enter for attendance at lectures only. * * * * * The comparatively small sum, that will be needed to provide the means necessary, to give effect to the foregoing proposals, will represent but a very insignificant amount when contrasted with the importance of the results that may spring from the education to be given. In the Irish Agricultural Institution in Dublin *nearly the whole of the students are boarded and educated at the entire expense of Government.* The same is done in nearly all the countries of Europe in which small farms prevail, while in the United States every State Agricultural College provides board and education for a number of youths—sometimes as many as one hundred—entirely at the expense of the State, and if such is necessary in these countries, surely we need to do as much in this Presidency."

7. The Board in submitting to Government this letter seemed (one member however dissenting) to have changed their views to a considerable extent, and they now advocated the postponement of the educational scheme until further information regarding the state of agriculture in the Presidency had been collected.

8. The system under which the apprentices were being trained at Sydapet, continued, therefore, unchanged. In my report for the official year ending 31st of March 1874 I again wrote regarding these apprentices :—

"Though, making due allowance for the circumstances under which they were placed, these apprentices have done fairly satisfactory, they have made but very little progress towards qualifying themselves to hold District Farm Superintendentships; however, they are not to be blamed on this account; it was decidedly a mistake to suppose that Hindu youths, without any knowledge whatever of agriculture or of kindred subjects, would, in the space of three years, by mere field employment on the Sydapet Farm, become qualified to hold the Superintendentships of District Farms. Such a training as I have often pointed out, should qualify them to manage small farms of their own, situated in localities similarly circumstanced to the Sydapet Farms, and it should qualify them for employment as Overseers under efficient superintendence; but it could not in reason be expected to do more than this. Under a good system of theoretical and practical training in the lecture-room and the field, there would be no difficulty whatever in training educated native youths thoroughly in agriculture."

9. In G.O., dated the 19th of March 1875, Government reviewed generally the proposals for engaging in agricultural instruction and expressed the opinion that though the scheme I had submitted was beyond present requirements, it was, nevertheless, desirable to make use of the means at hand for the commencement of agricultural education, and they accordingly directed the Board, in communication with me, to submit a detailed scheme under which a definite course of instruction could be afforded.

10. In the Proceedings of the Board, No. 969, dated the 20th of April 1875, I was directed to draw up and submit the detailed scheme called for by Government. I accordingly drew up a scheme and submitted it in the form of a draft prospectus; this, after undergoing some slight modifications, was sanctioned by Government.

11. The following extracts are from this revised prospectus :—

"OBJECTS.

"This institution is designed to afford instruction in the science of agriculture and in the practical application of sound principles in conducting the ordinary agriculture of this country.

" MANAGEMENT, &c.

" This institution will be attached to the Educational Department under the general control of the Director of Public Instruction, acting in communication with the Board of Revenue. The direct management of the institution will be entrusted to the Superintendent of Government Farms, who will conduct all correspondence regarding the institution, will issue all notices, orders, &c., regarding the delivery of lectures and other matters connected with the routine of the institution, and will maintain discipline amongst the students who will, in all things, be subject to the orders he may issue.

" INSTRUCTION, &c.

" The course of instruction will extend over three years; there will be two sessions in each year, a Summer Session and a Winter Session; the Summer Session will begin each year on the 1st of April and will end on the 30th of June; the Winter Session will begin on the 1st of October and will end on the 31st of March. Though in the Winter Session class-room and lecture-room instruction will not begin until the 1st of October, students will nevertheless be expected to attend at Sydapet on the 1st of September, in order that they may witness and take part in the important field operations conducted at that season in connexion with the sowing of the cold-weather crops.

" The instruction given in the institution will embrace a thorough study of agriculture and of such portions of Chemistry, Geology, Zoology, Botany, and the Veterinary Art as bear on the theory and practice of agriculture. In addition to these special subjects, the following will also receive attention :—Farm book-keeping, land-surveying, mensuration, and drawing. The instruction will be given by means of lectures, class-room discussions, and field classes.

" During the portion of the day set apart for practical instruction in farming out of doors, every student will be expected to take part in whatever work is going forward on the farm; compliance with this regulation will be strictly enforced. Each student will be expected to make himself acquainted with all the operations daily performed on the farm, and will be required to keep a journal or diary of the same.

" Instruction will be conveyed in the English language, but the Masters will afford as much assistance as possible in explaining the lectures, and instruction generally, to students whose limited acquaintance with English may make it difficult for them to follow such instruction without explanation.

" ADMISSION.

" Europeans, Eurasians, and Natives of all classes are eligible for admission into the institution when vacancies exist, on complying with the following conditions :—

" Candidates who desire to avail themselves of stipendiary studentships or scholarships must be between sixteen and twenty-four years of age, and must produce with their application for admission the following certificates :—

(*a.*) Certificate of age.
(*b.*) Do. of character.
(*c*) Do. of physical fitness.*

" For the present no fee will be charged except in the case of students who enter only for instruction in special subjects; strict conformity with all the rules of the institution will be enforced.

" Students must provide themselves with all necessary text-books, stationery, &c.

" Students who have passed the Matriculation or General Test Examinations will be eligible for admission without undergoing any further examination, provided they produce the certificates needed, and comply with the other conditions laid down. When there is a greater number of these candidates than there are vacancies to fill, a selection will be made of the most promising, at the discretion of the Superintendent.

When there are more vacancies to fill than there are candidates qualified, as stated in the preceding paragraph, the entrance examination will be as follows :—

English.—Ability to write correctly and legibly from dictation and express themselves with reasonable correctness and intelligence in a letter or in a report.

* Should state that the candidate has been vaccinated.

Arithmetic.—The first four simple and compound rules, vulgar and decimal fractions.

Vernacular.—Tamil or Telugu (in the case of Europeans and Eurasians only); ability to translate into English easy sentences from an elementary vernacular prose work commonly used in schools.

History.—The leading facts of the Histories of India and England.

Geography.—The Outline of Geography generally and the Geography of India in particular."

"STIPENDIARY STUDENTSHIPS.

Of the students who have at the close of the first session been most successful, twenty-four will be selected to fill stipendiary studentships, to be established by Government, to which will be attached a monthly salary of Rupees 12-8-0 in the latter half of the first year, Rupees 15 per mensem in the second year, and Rupees 17-8-0 per mensem in the third year, under the following conditions :—

No stipend will be increased until the prescribed examinations have been satisfactorily passed. The stipend will be liable to be forfeited in part or in whole for continued disobedience to orders or neglect of duty, and no person who holds a stipendiary studentship will continue to hold it if found to be unfit to undergo further training from incapacity or want of interest. No stipend can be held for more than two and-a-half years, and cannot be retained unless the recipient pass for the higher grade within twelve months."

"SCHOLARSHIPS.

Three scholarships, each of the value of Rupees 10 per mensem, and tenable for two years under certain conditions, will be given to the three students who, at the end of the first year of training, secure the largest number of marks, and who, in other respects, have given satisfaction. These scholarships are to be held under the same general conditions as are applicable to stipendiary studentships."

"AGRICULTURAL CERTIFICATE.

At the conclusion of the course of training, each student who is found to possess the necessary knowledge, and whose conduct has been satisfactory, will be entitled to a certificate, certifying to his qualifications as an agriculturist."

"SCHOOL-TEACHERS AND OTHERS.

Arrangements will be made under which young men, who are studying in Madras to qualify themselves as school-teachers, will be permitted to attend one or more courses of lectures and to undergo a partial training in practical agriculture at the institution, with a view to teaching this subject in middle-class and elementary schools that may come under their charge."

"GENERAL.

Land-owners and others may enter students at the institution under the same rules and regulations as Government Stipendiary Students, provided the stipends are paid regularly one month in advance to the Superintendent, Government Farms, by whom these stipends will be disbursed under the rules prescribed.

Persons of any age above sixteen who possess a fair knowledge of English may enter the institution to study any special subject or subjects taught therein. They will be required to pay a fee of Rupees 2 per mensem during the time their names are entered in the register of the institution.

"CURRICULUM OF STUDY.

First Year.

Agriculture—Elementary.
Zoology.
Chemistry—Inorganic.
Veterinary—Animal Physiology and Anatomy.
Botany—Vegetable Physiology.
Drawing—Elementary.
Land-surveying and Mensuration.

Second Year.

Agriculture—Crops and Stock.
Geology—Elementary.
Chemistry—Organic.
Veterinary—Therapeutics and Materia Medica.
Botany—General.
Drawing—Plans.
Land-surveying and Mensuration.

Third Year.

Agriculture.
Geology—Agricultural.
Chemistry—Agricultural.
Veterinary—Pathology.
Botany—Agricultural and Horticultural.
Drawing—Machines, &c.
Mechanics, Farm Book-keeping, &c."

Time Table.

Monday	6 to 10 A.M.	Field Class	Land-surveying.
	3 to 4 P.M.	Class Room	Arithmetic.
	4 to 5 do.	Lecture	Agriculture.
	5 to 6 do.	Practical Farm Work.	
Tuesday	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Veterinary.
	3 to 4 P.M.	Class Room	Mensuration.
	4 to 5 do.	Lecture	Botany.
	5 to 6 do.	Practical Farm Work.	
Wednesday	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Chemistry.
	3 to 4 P.M.	Class Room	Arithmetic.
	4 to 5 do.	Lecture	Zoology.
	5 to 6 do.	Practical Farm Work.	
Thursday	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Veterinary.
	3 to 4 P.M.	Class Room	Mensuration.
	4 to 5 do.	Lecture	Agriculture.
	5 to 6 do.	Field Class	Do.
Friday	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Chemistry.
	3 to 4 P.M.	Class Room	Arithmetic.
	4 to 5 do.	Lecture	Botany.
	5 to 6 do.	Field Class	Do.
Saturday	6 to 7-30 A.M.	Practical Farm Work.	
	8 to 9 do.	Weekly Examination.	

12. Under the orders of Government this prospectus was published in the *Fort St. George Gazette* and in the local *Gazettes* of this Presidency, and soon afterwards numerous applications for admission into the institution, began to be received from candidates resident in various parts of this Presidency and in the Presidency of Bombay.

13. At first, it was intended to open the institution in the beginning of October, but various circumstances combined to prevent the carrying out of this intention. Before the middle of September, 43 young men had entered their names as candidates for admission into the College, the whole of these produced the necessary certificates of age, physical fitness, vaccination and character. Of these, 17 were qualified for immediate admission into the institution, having passed the Matriculation and other examinations prescribed. The remainder, 26, entered their names as intending competitors at the entrance examination. The entrance examination was held at Sydapet, and at the head-quarters of 2 or 3 districts, on the 23rd

October; and of the candidates who attended, 12 were selected and admitted into the institution. But, before the institution began its work, a number of the first accepted candidates asked for, and were granted, permission to withdraw their names from the roll of the institution, chiefly on account of the famine rendering it impossible, in the majority of the instances, for the parents of the youths to bear the additional cost of the maintenance of their sons at Sydapet. For the vacancies thus caused there were, however, numerous candidates, and from the best of these who had passed the Matriculation or other examinations prescribed, and who, had produced certificates of physical fitness, &c., I selected a number, sufficient for the accommodation available. These accepted candidates were as follow :—

9 Parsees.
10 Brahmins.
10 Vellalars and other castes.
1 Native Christian.

They belonged to the following places ;—

3 South Canara District.
3 Coimbatore District.
3 Chingleput District.
1 North Arcot District.
7 Madras District.
1 Tanjore District.
1 Trichinopoly District.
9 Districts of the Bombay Presidency.
1 Ceylon.
1 Mysore.
—
30
—

14. The ages of these men were ;—

Nine aged from 18 to 20 years.
Nine aged from 20 to 22 years.
Twelve aged from 22 to 23 years.

15. The great difficulty experienced, in starting the institution, was the absence of the necessary house-accommodation. Eventually it was decided to make use of, as a temporary arrangement, the granary building attached to the Sydapet Experimental Farm. This is a two storied building and consists of two rooms on the ground floor and one upper room. This building, though very commodious as a granary, is very inconvenient and unsuitable for the purposes of the Institution; the height of the rooms on the ground floor, is less than 9 feet, and, the class room, which is only 30 × 20 feet, is therefore exceedingly close and hot, when it contains the usual class of 30 adults. The upper room, used as a lecture room, is 60 feet long and 20 feet broad, the height of this room to the wall plates is not more than 6 feet, but the roof is open to the ridge plate, which affords better ventilation than is the case with the rooms on the ground floor; but this room is almost as ill adapted for use as a lecture room as are the ground floor rooms for use as class rooms; when there are, as is frequently the case at the agricultural lectures, as many as 50 adults in the room, it is exceedingly uncomfortable; and, from the narrowness of the room, many of the students are necessarily seated so far back from the lecture platform, they, not only experience great difficulty in seeing distinctly the drawings made during lectures on the black board, but also, occasionally, find it difficult to hear the lecturer fully. It is impossible to keep the room moderately cool in the hot season, for the walls are exposed fully to the sun, and the windows are altogether without verandahs or shades; and, from the room being already dark when the sky is at all clouded, the windows cannot be furnished with shades; and another very serious inconvenience which arises from the absence of window shades, is the impossibility of keeping the rain from drifting across the room when there is even

Unsuitability of house-accommodation.

only a very slight wind during a shower. On such occasions, I have had no alternative but to dismiss the class; for, if the window shutters were closed, the room would be so darkened that no work could be done; glass windows would render the room too hot. Light as the rains were during the past session, I had on several occasions to close the Institution from the impossibility of lectures being delivered in the room while rain was drifting through it. I look upon the absence of proper accommodation, in the shape of lecture rooms and class rooms, as a most serious detriment to the work of the institution. Plans and estimates have been prepared, and approved, for providing the necessary buildings, and the funds required are available, I venture to hope therefore that before the expiration of another year the necessary accommodation will be provided.

Institution had to be closed in wet weather.

The absence of proper house-accommodation a serious detriment to progress.

16. His Highness the Holkar founded two stipendiaryships connected with the institution, each of the value of Rupees 25 per mensem. For these stipendiaryships two young men were selected and sent to the College by the Minister of His Highness the Maharajah. These young men signed an agreement by which they undertook to serve the Government of His Highness the Holkar, as Agricultural Instructors, after the completion of their training in the College. The action of His Highness the Holkar in this matter is very encouraging; it is greatly to be desired that the example should be extensively followed.

Holkar State Stipendiaryships.

17. The accommodation being so limited only two or three students could be admitted to study special subjects.

Students studying special subject.

18. Arrangements were made whereby some of the students of the Normal School in Madras, could attend the Agricultural Lectures; of these students 13 attended. These are Matriculates and First Arts men. They are intended to be teachers in Higher-class, Middle-class, and Normal Schools. Some of them may become masters in schools in which agriculture will be taught. Others may, as Deputy Inspectors, have to examine schools in which agriculture will form a part of the curriculum.

Normal School Students.

19. During nearly the whole of the Session applications for admission into the institution were frequently received. The following statement shows the number of these applicants, and the District, Province, or Presidency to which they belonged :—

Numerous applications for admission.

Applicants from	Madras District	31
Do.	Chingleput District	16
Do.	North Arcot do.	8
Do.	Salem do.	1
Do.	Mysore Province	1
Do.	Tanjore District	30
Do.	Trichinopoly District	2
Do.	Coimbatore do.	9
Do.	Malabar do.	1
Do.	South Canara do.	6
Do.	Madura do.	3
Do.	Tinnevelly do.	1
Do.	Kistna do.	1
Do.	Bombay Presidency	31
Do.	Bengal do.	1
Do.	Punjaub Province	1
Do.	Oudh do.	1
Do.	Ceylon	1
	Total	145

20. The next statement shows the caste or nationality of these applicants—

Brahmins	63
Parsees	26
Vellalars	8
Idaiyars	5
Vanniars	12
Chetties	3
Christians	3
Mussulmans	2
Kammalars	2
Kshatriyas	1
Unknown caste	20
Total ..	145

We were quite unable to accommodate more students, and I had, most reluctantly, to refuse to admit many, apparently, very eligible candidates.

21. It is a matter of some interest, and I think a very promising sign, the large proportion of these applicants that were Brahmins. The Brahmins are, in the agricultural districts of this Presidency, the leaders of the people, and are much looked up to by the cultivators for advice in the management of land. It may not be generally known that one-quarter of the entire male Brahmin population consists of cultivators, and about 12 per cent. of land-holders; thus more than one-third of the entire male Brahmin population is actively engaged in pursuits connected with the land. The large number of Parsee candidates was also a very encouraging sign. If these enterprising go-a-head people turn their attention to agriculture, much good may be looked for. In many respects Parsees are particularly well suited to be agriculturists. It is to be hoped that the College may be the means of inducing many of them to devote themselves to agriculture, which sadly needs a little of that energy and enterprise which has been so conspicuously shown by Parsees in commercial and manufacturing enterprises.

22. I would particularly invite attention to the numbers of eligible candidates who from so many parts of India sought admission into the institution. In the earlier part of this report in the second paragraph I drew attention to the difficulties experienced, only as recent as 1871, in inducing eligible persons to offer themselves for a course of training in agriculture, even when the inducements offered were of a most substantial kind. The change that has taken place in the opinions of the educated youth of this country, regarding agriculture as a field of employment, must, I think, be very gratifying to all who desire to see this country prosper.

23. The institution did not begin work until the middle of November. A very efficient staff of lecturers was appointed to instruct the students; the majority of these gentlemen, were already engaged in teaching, in the Madras Medical College. The subjects of instruction were;—

Agriculture—Soils and Manures.
Veterinary—Animal Physiology and Anatomy.
Botany—Elementary.
Chemistry—Inorganic.
Zoology—Mammals and Birds.
Arithmetic—Decimals, Rule of Three, &c.
Mensuration—Principles of Geometry and Mensuration of surfaces.
Surveying—Measurement of small areas with the chain.

On each of these subjects a course of lectures was delivered. The following extracts, are from the reports of the lecturers and others on the work of the past Session:—

W. R. ROBERTSON, M.R.A.C., (AGRICULTURE).

"The class met 44 times; 28 of these meetings were devoted to lectures, 13 to field classes, and 3 to formal examinations.

"The class was composed of 45 members, 13 of whom were students of the Normal School.

"The attendance of the students was very satisfactory. The Normal students unfortunately, owing to their vacation falling during the Session, were able to attend only 2 lectures.

"I was very much gratified with the progress made by the class generally. The conduct of all was good.

"The lectures delivered were generally on soils and manures. At the field classes attention was chiefly directed to the practical illustrations afforded in the fields to the instructions given in the lecture-room. Owing to the prevalence of the drought ordinary agricultural work was not so active as usual, but many valuable lessons were learnt as to the means available to the agriculturist for modifying the ill-effects of such unfavorable seasons."

G. WESTERN, M.R.C.V.S., (VETERINARY).

"The class met 22 times, and the allotted hour was occupied with lectures, anatomical demonstrations, and occasional *vivâ voce* examinations. The class consisted of 30 students.

"I have found the members of the class throughout the Session attentive and eager to learn, and have been agreeably surprised at the very creditable papers written by the majority at the examinations. I must however, I regret to state, except some four or five from this general commendation.

"I have experienced much difficulty in procuring specimens to illustrate my lectures, and fear that in consequence the matter thereof has not always been so well understood as it might otherwise have been. This might be remedied in future by procuring a good selection of anatomical models and diagrams of the more important parts and organs of animals from Europe. For diagrams I have hitherto had to depend entirely on what I could prepare privately or obtain on loan from the Curator of the Government Central Museum, and I am much indebted to that officer for assistance in this respect.

"The instruction hitherto given has been of the most elementary description, my intention being to give a general outline of the structure and functions of the organs of the animals of the farm, and subsequently to reconsider the various branches of the subject in the order of their importance and interest to the agriculturist."

R. WILKINS, F.R.C.S., (BOTANY).

"At the commencement of the Session there were 16 students in the class; very shortly afterwards the number was increased to 32.

"Lectures on the subject were delivered bi-weekly; the number up to 31st March amounted to 22. They embraced an account of roots, stems, leaves, and flowers, and were illustrated by sketches on the black-board and by fresh and dried specimens.

"One oral and three written examinations were held, for which marks have been assigned. In addition to these, the class was examined for a few minutes at a time, at every meeting, on the subject of the previous lecture.

"All the students conducted themselves well, and I am satisfied with the progress made by most of them; a few have not done well."

W. HAMILTON, (CHEMISTRY).

"The number of meetings has been 29. Three examinations were held, two class and one sessional. In addition the students were examined at each meeting, for 20 minutes, on subjects which were considered in the previous lecture.

"The lectures were, as far as practicable, illustrated by experiments.

"At the commencement of the Session there were 16 men. Fresh admissions were granted from time to time, until the total number on the roll amounted to 32.

"The conduct of the students has been unexceptionable, and their industry good. Many of the men in the class are intelligent, and have evinced a fair degree of aptitude in grasping the facts and theories of the subject. A few from defective preliminary training and inadequate knowledge of English have kept far behind the others. About one-half of the class have made good progress."

J. KEESS, M.D., &c., (ZOOLOGY).

"The class met 14 times during the course of the Session, and had one oral examination and two written examinations.

"Mammals and birds formed the subject of my lectures. The students exhibited great interest in the subject of zoology.

"The behaviour of the class has been unexceptionable."

A. GANAPATI AIYER, F.A., (ARITHMETIC).

"The class met 24 times; 22 lessons were given and two examinations held. The portions studied were Decimal Fractions and Simple Rule of Three.

"The class consisted of 28 students.

"The conduct of the class was on the whole satisfactory, and the students with a few exceptions acquitted themselves very creditably at the examinations held during the Session."

T. V. SEETHARAM MOODELLY, (MENSURATION AND SURVEYING).

"The class commenced on the 15th January 1877 and met 11 times.

"The subjects taught were: Principles of Geometry and Mensuration of surfaces.

"The Surveying class met seven times. The work done was only surveying with the chain. The conduct of the class during the Session was good."

24. The cottages on the Farm, which had been built for the occupation of the apprentices, have been rented to the students; and, as these cottages were not sufficient, for the number of students who desired to reside on the Farm, arrangements have been made for building several more. The original educational scheme did not provide for the residence of the students on the Farm; but it is certainly, in every way, much more desirable that they should reside there, than in the town of Sydapet.

25. A Reading-room has been fitted up for the use of the students, who have made good use of it. The room is provided with Agricultural News-papers, but, not to the extent that is desirable.

26. A beginning has been made in forming an Agricultural Museum. A fair collection of grains and pulses has been formed. Several skeletons for illustrating the Lectures on Animal Physiology have been received from the Superintendent of the Central Museum, to whom, also, we are indebted for several stuffed fish of the different species found in the Adyar river. Sets of Botanical, Zoological and Mechanical diagrams, as well as some models and two microscopes, have been received from the Secretary of State for India.

27. A Laboratory is urgently needed; without it the instruction in Chemistry cannot be as practical as is desirable.

*28. It is to be regretted that the Normal School students were able to attend so very few lectures; the causes were partly, from the demands of their own institution on their time having on one or two occasions prevented their appearance at the Agricultural Lecture, and partly, from the difference in the Sessions of the two Institutions; the Normal School students having been dispersed very shortly after our Session began, and the new class in the Normal School was formed so late in our Session that I, and the Principal of the Normal School agreed with me, thought that the students could not profit much by attending the Agricultural Lectures, then so near the end of the course, from having missed the preceding lectures. The arrangements for the attendance of the Normal School students at the Agricultural Lectures, will require to be reconsidered. Our Sessions, are convenient as regards the Agricultural seasons here, and it is therefore very undesir-

* During the Summer Session but few lectures were unattended by them.

able to alter them; and it is probably as undesirable to alter the Sessions of the Normal School. If more satisfactory arrangements cannot be made for the agricultural education of the students of the Normal School, it will become a matter for serious consideration, whether it would not be better to impart agricultural information, in a few of the principal schools of the Presidency, by means of men who have gone through the entire course of training at the Agricultural College, either, in addition to the means now proposed, or, in substitution for them. Perhaps, a system could be adopted, something similar to that of the Science and Art Department at Kensington in conducting technical and scientific education in different parts of England.

29. The following statement, shows the marks obtained by each student (Normal School students excepted) at the examinations, and, for attendance, during the Session :—

Statement showing the Marks obtained by the Students during the Winter Session ending the 31st of March 1877.

Rank Number.	Name and Register Number.	Weekly Examinations.													Sessional Examinations.					Total.	Attendance Marks.	Grand Total.
		Agriculture, 27th January 1877.	Veterinary, 3rd February.	Chemistry, 10th February.	Arithmetic, 12th February.	Botany, 17th February.	Mensuration, 22nd February.	Zoology, 24th February.	Agriculture, 3rd March.	Arithmetic, 5th March.	Veterinary, 10th March.	Chemistry, 17th March.	Botany, 24th Mar.	Mensuration, 4th April.	Agriculture, 26th March.	Veterinary, March.	Chemistry, March.	Botany, 29th Mar.	Zoology, 4th April.			
1	10. G. Krishna Prabhu	68	81	85	100	95	65	90	94	85	90	74	77	88	275	178	172	195	185	2,097	112	2,209
2	5. N. H. Patuck	56	82	94	74	79	87	75	94	82	91	95	74	81	265	169	200	170	125	1,993	118	2,111
3	26. C. K. Subba Row	74	84	88	73	90	85	65	75	99	83	88	71	88	273	138	151	178	135	1,938	120	2,058
4	14. V. S. Gurunatha Pillay	83	45	84	90	54	85	75	84	98	58	57	60	81	280	115	126	161	140	1,776	114	1,890
5	11. M. Narayana Row	69	66	82	49	89	74	70	86	52	86	55	70	77	246	155	115	150	105	1,696	116	1,812
6	2. P. D. Moody	85	78	65	50	61	66	70	90	36	70	75	77	48	247	92	94	180	155	1,639	113	1,752
7	17. B. Ramiah Reddy	46	68	62	55	72	93	38	81	66	79	39	63	80	248	125	104	180	100	1,599	116	1,715
8	7. C. Annamalay Moodelly	80	76	63	64	74	58	90	72	52	56	42	50	35	271	87	82	166	165	1,583	112	1,695
9	4. J. M. Chichgar	61	77	68	28	76	61	70	92	36	81	59	37	18	259	136	135	165	115	1,574	120	1,694
10	25. K. M. Nagojee Row	51	59	69	64	71	76	18	77	84	82	37	65	53	237	136	92	135	155	1,561	122	1,683
11	27. E. B. Krishna Row	60	44	57	75	54	68	68	67	99	57	44	54	49	248	90	94	121	115	1,464	114	1,578
12	16. V. Streenivasa Iyer	69	61	59	50	71	80	40	73	85	60	62	69	59	197	86	84	140	100	1,445	91	1,536
13	15. N. M. Rego	72	37	52	20	61	56	60	77	68	54	61	32	77	265	82	108	129	95	1,406	119	1,525
14	1. T. Balasundracharry	78	51	49	30	57	62	80	71	85	51	43	38	46	213	74	108	164	105	1,405	108	1,513
15	28. A. D. Colah	66	58	61	10	77	56	60	74	10	47	53	62	26	250	116	87	156	120	1,389	118	1,507
16	30. B H. Kotwal	57	54	82	40	64	74	70	65	22	80	56	38	5	210	91	112	112	145	1,377	115	1,492
17	8. F. N. Kambatta	52	34	48	45	60	64	30	63	47	53	42	41	53	205	88	121	131	90	1,267	120	1,387
18	19. M. Damodara Moodelly	58	40	55	25	61	79	75	72	31	58	45	50	49	210	49	62	128	105	1,252	119	1,371
19	9. A. Mooroogasa Pillay	68	38	55	74	59	67	60	56	69	28	17	17	50	168	35	48	146	120	1,175	120	1,295
20	3. T. Varathiah	73	28	31	..	50	66	40	71	50	55	28	39	44	224	58	57	123	90	1,127	120	1,247
21	29. B. M. Dadiana	38	35	69	10	41	55	50	56	17	48	55	51	23	226	52	85	76	70	1,057	120	1,177
22	20. R. Thamodara Naidu	..	..	44	29	50	57	40	47	25	37	34	51	51	230	56	76	153	95	1,075	58	1,133
23	22. M. N. Swernalinga Naicker	58	41	17	30	48	56	55	38	22	42	11	37	22	199	34	30	114	85	939	108	1,047
24	21. P. Jagannada Moodelly	71	25	45	5	49	46	50	43	20	35	20	37	10	210	46	31	122	55	920	119	1,039
25	6. J. F. Lally	51	43	15	20	43	40	20	41	10	39	19	10	10	142	34	42	99	55	733	108	841
26	23. C. S. Streenivasa Row	36	7	8	5	22	43	10	28	10	8	9	20	23	167	56	42	56	95	645	93	738
27	18. C. Cuppusawmy Auchary	69	31	..	..	..	..	..	..	..	..	..	16	65	143	22	35	108	50	539	30	509
	Full Marks ..	100	100	100	100	100	100	100	100	100	100	100	100	100	300	200	200	200	200	2,400	122	2,522

30. In the Appendix will be found copies of the examination question-papers of the Session, these will afford a very fair idea of the character of the instruction given in the College.

31. The prizes for Note books, were awarded as below :—

Agriculture ..	1st,	N. H. Patuck.
	2nd,	V. S. Gurunatha Pillay.
	3rd,	A. D. Colah.
		B. H Kotwal.
Botany	1st,	B. H. Kotwal.
	2nd,	A. D. Colah.
	3rd,	V. S. Gurunatha Pillay.
Veterinary ..	1st,	A. D. Colah.
	2nd,	M. Narayana Row.
	3rd,	N. H. Patuck.
Chemistry ..	1st,	P. D. Moody.
	2nd,	B. H. Kotwal.
	3rd,	V. S. Gurunatha Pillay.
Zoology	1st,	B. H. Kotwal.
	2nd,	V. S. Gurunatha Pillay.
	3rd,	A. D. Colah.
		N. M. Rego.
		N. H. Patuck.

32. The expenses incurred, on account of the institution, are shown in the next statement :—

—	August.	September.	October.	November.	December.	January 1877.	February.	March.	Total.	Grand Total.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Agricultural Lecturer ..	....	....	....	....	....	....	....	....	....	
Veterinary do. ..	....	....	....	....	20 0 0	120 0 0	140 0 0	160 0 0	440 0 0	
Chemical do. ..	....	....	....	....	20 0 0	140 0 0	140 0 0	160 0 0	460 0 0	
Botanical do. ..	....	....	....	....	20 0 0	140 0 0	140 0 0	140 0 0	440 0 0	
Zoological do. ..	....	....	....	....	20 0 0	80 0 0	100 0 0	80 0 0	280 0 0	1,620 0 0
First Master	....	....	....	150 0 0	150 0 0	150 0 0	150 0 0	150 0 0	750 0 0	
Second Master	....	....	....	....	....	....	54 13 5	100 0 0	154 13 5	
Clerk	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	200 0 0	
Draftsman	....	....	....	4 15 2	20 13 4	24 3 1	24 0 0	23 3 5	97 3 0	
Muchee	....	....	....	....	4 0 0	6 11 10	10 2 1	9 8 0	30 5 11	
Peons and other servants.	....	....	....	....	13 11 3	23 0 0	27 4 2	26 0 0	89 15 5	1,322 5 9
Special Charges.										
Furniture	177 12 4	775 11 5	113 8 5	214 5 7	14 12 9	35 10 0	119 10 0	41 4 6	1,492 11 0	
Accommodation ..	....	271 0 8	87 10 11	38 4 7	134 13 0	209 8 7	16 2 0	12 6 6	769 14 3	
Contingencies	62 4 6	....	51 12 9	108 0 11	26 0 6	67 14 11	29 12 7	44 0 0	389 14 2	2,652 7 5
									Total ..	5,594 13 2

WILLIAM ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

29*th September* 1877.

THE CAROLINA PADDY EXPERIMENTS

IN THE

MADRAS PRESIDENCY.

INTRODUCTORY.

DURING the past 7 or 8 years a considerable number of reports have been submitted to the Board of Revenue, on experiments with Carolina paddy; some of which contain much useful information. It was thought that if this information could be collected, it would be of use to persons desirous of engaging in Carolina paddy culture in this Presidency. Accordingly, the reports were placed in my hands, in view to the utilization, in a general report, of whatever useful matter they might be found to contain.

2. I have done what I could in the desired direction, but the result is altogether disappointing, from the absence in so many of the reports of the necessary details. I first attempted to classify the results of the experiments, with reference to the climatical conditions under which each was obtained, but I found it impossible, except in a very few instances, to procure the necessary meteorological data, and this course I had to abandon. I next endeavoured to classify the experiments, according to the description of soil on which each was conducted but, from so many of the reports being silent as regards the soil used, this course also, I found impracticable. Next, I attempted to work up and arrange the results according to the peculiarities of culture adopted in each instance, but this likewise, I had to give up from the frequent absence of the required information.

3. Unfortunately, a very large proportion of the reports are valueless from being but the records of failures, from such causes as "floods," "trespassing cattle," "the depredations of birds, insects, &c.," "the failure of water-supply &c., &c." Nevertheless, a considerable amount of useful matter has been collected which, I trust, will be of use to those interested in paddy culture in this Presidency.

4. The numerous extracts I have taken from the reports, have been arranged, generally, as they bear on the crop during growth from seed time until harvest time. A Manual, or Guide, would probably have been more useful than this compilation, but it was desirable to give as far as possible the experiences and opinions of Experimenters located in different parts of the Presidency; and, such a Manual, or Guide to the cultivation of Carolina paddy, prepared with our present limited knowledge, could have been applicable only to the conditions met with in a small area of country.

5. I have endeavoured to show, generally, what has been effected in Carolina paddy culture, under moderately good agricultural conditions, and, generally, the means, by which such results were obtained. Had it been possible to give the exact conditions, history and results in full detail, of a few experiments made in each of the different Collectorates, the information afforded, would have been much more valuable than that now submitted. Though, in recording the history of their experiments, some Reporters have entered fully into details as regards some points of interest, they have, in many instances, overlooked others of equal value, without which the details given are of much less value than otherwise they would have been. I am conscious

that, the connection between the different yields obtained, and the different modifications in the cultivation practices followed, cannot be traced in this report; but, the material available would admit of no other treatment than that I have adopted.

6. The deficiencies of this report however, as a guide to the cultivation of Carolina paddy, are fully compensated for, by the ample, and exact information afforded, regarding the culture of the plant in its home, in America, which I have placed at the end of this report; the more nearly the methods of culture adopted in Madras, approximate to the methods of culture adopted in America, the more likely will successful results be secured. That the climate of Madras, generally, is suited for the Carolina paddy plant has been amply proved. It remains for the Indian cultivator, by adopting an intelligent practice, to secure to the plant those good agricultural conditions which, in America, it invariably meets with.

Large importation of seed from America.

7. In 1869, a large quantity of Carolina paddy of the "gold seed" variety was purchased in America for shipment to India. Of this lot 150 barrels were forwarded to Madras. The Madras supply reached its destination early in 1870; it consisted of 300 bushels; the whole of the grain was perfectly fresh, and contained 92 per cent. of vital seed. In 1872 a further supply, a few barrels, of fresh seed was imported. The quality of the grain was quite equal to that of the supply received in 1870. In 1873, another small supply of fresh seed was received; this grain was also in good order, but it contained only 87 per cent. of vital seed and it was mixed with about 3 per cent. of the grain of an inferior paddy, known to American Planters as "Volunteer" paddy.

The whole of the seed good.

In all, since 1870, about 400 bushels of Carolina paddy seed have been introduced into this Presidency, and with the exception of the drawbacks noticed, regarding the supply of 1873, the whole was of first-rate quality. The seed was, in most instances, supplied to Experimenters gratis, and delivered free of charge. It was widely distributed in all parts of the Presidency where paddy is cultivated.

Seed widely distributed over the Presidency.

The Soils, and their preparation for the Crop.

8. The soils were ordinary paddy soils under irrigation from river-channels, or tanks; generally situated at low levels, and of alluvial origin. The land frequently was terraced, which arrangement admits of the thorough removal of the irrigation water when done with. Much of the land was however so situated that it could not be drained excepting by artificial means, and, the Ryot has not yet recognized the importance of getting rid of the irrigation water after it has fulfilled its purpose, by such means.

No means provided for escape of stagnant water.

9. In preparing the soil, the ordinary native methods were usually adopted; these, varied considerably in different parts of the Presidency. In some localities the land was ploughed 7 or 8 times when intended to receive seedling paddy plants. During this preparation, the soil was generally kept covered with water to a depth of 3 or 4 inches; in this way the surface soil was worked by the ploughs into a semi-liquid mud, while the layer of soil, immediately below, was puddled and hardened by the feet of the cattle. In some instances, while undergoing preparation, this continued over several days, the soil was manured with the green plant of the Mudder (*Calotropis gigantea*), wild indigo, &c., and with the leaves of different descriptions of trees, at the rate of from 400 to 1,000 lbs. per acre; but, most of the land was unmanured excepting by the silt deposited on it by the irrigation water.

Soil worked into mud.

Manure.

10. Usually, the soil was prepared for seed in much the same way, as when intended to receive seedlings. In either case, the surface was worked into a puddle, the process being more thoroughly performed when it was intended to plant seedlings. The following extracts, from the reports, show how this puddling process was carried out:—

"After standing thus for two days until thoroughly saturated, water was again let on the field to the depth of 2 inches. On the following day the land was again

ploughed thrice and the mire left to stagnate for two days after which it was manured with street sweepings, cattle litter, &c. On the following day the field was again ploughed three times and watered to the depth of one inch, the surface of the mire being smoothed by means of a plank drawn by bullocks; after this the soil was manured with leaves and green plant which were trodden into the puddled soil."

"The plots were puddled and worked according to the usual Native system. The manure was put into the puddle and worked thoroughly amongst it by means of the plough. The seedlings were not planted out until the first effects of the rapid putrefaction of the manure had passed off. * * * Before planting commenced the soil was again thoroughly puddled. The plants were put down in bunches of two or three, placed about eight or nine inches apart; they were usually pressed into the puddle by the hands of the coolies; very little pressure was required; the puddle was so soft, eight coolies planted an acre per day."

"The ground was turned up with the ordinary small plough of the country in August, one month before the seed was put down. Again five days before sowing it received two ploughings on the same day; again two days before sowing it received two ploughings; and lastly the manure, leaves, and dung were put down; the ground was again ploughed twice over, after which the seed was sown. At the time of sowing the land was under water and in a puddle."

"The grounds were ploughed up six times with the country plough. The slices of soil were well broken and the ground was then levelled. Jungle leaves were mixed through the surface of the soil, and it was left alone in that state for a period of 35 days, so that the necessary putrefaction of the leaves might take place. By that time the puddle became sufficiently putrefied and produced a noxious smell. The land was again ploughed up twice by means of the country plough."
This latter description refers to the preparation of the soil for seed.

11. In some instances, the soil was prepared without undergoing puddling. The following extract, describes this practice:—

"In this kind of sowing the Ryots generally keep the land ready well ploughed and manured and await a moderate shower of rain to commence the sowing. As soon as they get rain and the ground is sufficiently saturated the seed is sown in lines by means of a bamboo seed-drill. If the rain is heavy, they wait for two or three days till the ground is sufficiently drained. If the weather is showery, no irrigation water is applied during the first three or four weeks, and the grass which springs up in the interval is removed by frequent weedings."

The puddling of the soil objectionable.

12. There can be no doubt but that the puddling of the soil as described in some of the foregoing extracts, is highly objectionable. The physical character of the soil is very injuriously affected as, from the semi-liquid state into which the soil is worked, the heavier particles sink below, hence the surface soil, which is formed of the finer matter, is close and compact, a condition highly favorable to the retention of water on its surface, if this, was a result desirable to secure, but, as the good effect of irrigation water, depends upon the water *passing into and through the soil*, the condition referred to, is very objectionable. It is true that, when land has once been puddled, it is difficult, at first, to work it, in a satisfactory manner, in any other way, but, if in each year the puddling process is less fully carried out, the soil will gradually be restored to its normal condition.

The irrigation water should pass through the soil.

Puddling obstructs the passage of the irrigation water down through the soil.

The puddling of the soil is done in order to make the water, apparently, go further, but, where sufficient water cannot be commanded for paddy, without thus injuring the physical state of the soil, it would be better, in every respect, to crop the soil with some other crop. Some fairly good results have been obtained in Carolina paddy culture where the soil was puddled but it is evident that, in such instances, the land was either situated at a moderately high level, which admitted of good surface drainage, or, it rested on a moderately porous sub-soil. In some instances, where the land was thoroughly worked in a dry state, before irrigation commenced, the results, apparently, were not better, than when the puddling process was adopted, but, there may have been causes to account for this, of which the reports have taken no cognizance.

13. The Carolina paddy plots, in many instances, received better treatment, as regards manuring, than is usual in the treatment of land for ordinary paddy. This, probably, was because many of the plots were located near the head-quarters of a District, and away from the larger irrigation rivers, the waters of which, usually, bring down so much silt that manure is not considered to be needed on the land they irrigate. Owing to the swamping of the land, during irrigation, it is usual, when manure is applied, which is quite the exception, to apply some substance which by gradual decay affords plant food. If a quickly acting manure was used, the probability would be that it would all be dissolved in, or carried away by, the first irrigation flood the land received.

The experimental plots were not usually irrigated by water of the larger rivers.

The seed, seedlings, and the method of sowing and planting.

14. As before noticed, the seed was sometimes sown directly in the land, and, at other times, it was sown in nursery beds, in view to raise seedlings for transplanting. When sown broadcast on the puddled soil, the seed was usually in a sprouted state; the process followed in sprouting it is described in the following extract:—

"The seed, which is to be sown, is put in pots at sun-rise and water poured in them to the brim. The pots remain in that state till evening, when some straw is placed in the mouths of each and they are turned upside down. They remain in that state all night, during which time the water drains away. The next morning water is poured in the pots, but is immediately run off, and the pots are inverted again as on the previous evening. In this state they remain all day. The seed is then placed on baskets and wet straw is spread over each and kept on by weights. The following morning the seed begins to germinate when it is taken to the field for sowing."

15. The practice of transplanting paddy is not common throughout the Presidency. It appears to prevail more generally in those portions where the water-supply is good and labor abundant. Even where the practice is common, it is far from usual to raise the seedlings in nursery beds; frequently the Ryot sows one or two of his fields thickly, in view to the plants to be thinned out being used for planting other ground, and perhaps it is to this practice we must attribute some of the failures in the experiments with transplanted Carolina paddy seedlings. It has been shown, again and again, that, while the roots of the indigenous paddy are confined chiefly to the surface soil, those of the Carolina paddy go deep down into the soil when they meet with favorable conditions. The following extract from a report by the Superintendent of Government Farms dated 1872 shows this:—

"These roots are average specimens; they were collected off some land we ploughed on Saturday, from which crops of Carolina and country paddy had just been removed. The land is all of one description and quality and the crops were cultivated in an exactly similar way. The roots illustrate in a very forcible way the different habits of the two varieties of paddy; the Carolina *feeds deep down in the soil*, while the country variety is a *surface feeder*. It is evident therefore that land with a healthy surface, only about 3 inches in depth, can *never* produce a *good* crop of Carolina paddy, though it may produce fair crops of the country variety. In such soils the Carolina grows well enough until its roots begin to pass down into the unhealthy under-soil, when it sickens, turns yellow, and dies; while the country paddy, whose roots never reach this unhealthy under-surface, may thrive and yield fair results."

Many Experimenters, noticed the difficulty of taking up, uninjured, the seedling plants thus;—

"Much difficulty was experienced in pulling up the Carolina paddy plants for transplanting, the roots having struck so deep down (10 to 12 inches) into the soil."

"Difficulty was experienced in pulling up the plants for transplanting the process on a given quantity of land occupied twice the time within which the country paddy seedlings could be raised from the ground."

Transplanted seedlings injured from rough treatment.

16. An opinion appeared to be generally held that the Carolina plant cannot bear such ill-usage as that to which the country plant is usually exposed when being transplanted. But, the difference in the root growth of the two varieties of paddy, fully explains the matter. The evidence afforded in these reports is conclusive as to *the necessity of employing properly prepared nursery beds for raising Carolina paddy seedlings for transplanting.* Seedling plants of all ages from 20 to 50 days were used in the experiments. The general experience was, that seedlings aged from 20 to 28 days were the most suitable for transplanting. By the use of older seedlings there was, of course, some saving in the fewer number of days the crop required to be watered in the field, but this advantage was negatived, in most instances, by the more serious check these older seedlings received to their growth on being transplanted.

Irrigation, and, Culture of the Crop.

River-channels.

17. The irrigation water was, in most cases, derived from river-channels and tanks. The former of these convey to the fields river-water which has been obstructed in its downward passage to the sea by dams or anicuts. These dams or anicuts are usually placed across the river-beds in situations where there is plenty of room for storing water, and where, from the height to which the stored water can be raised, it will flow by gravitation through a channel to the land. The water of these irrigation rivers contains silt, at certain seasons a considerable quantity. The tanks, are natural or artificial reservoirs; they are usually filled by the surface drainage of the adjacent country after heavy rains; in some instances they are supplied with water from a neighbouring river, but such cases are rare. Generally the tanks are situated on sloping land so that, while they secure the surface drainage from the higher country, their water will yet flow by gravitation upon neighbouring land at lower levels.

Tanks.

Irrigation practice.

18. The irrigation practice of the Carolina paddy Experimenters, differed but little from that usually followed in the treatment of country paddy in the portions of country where the experiments were conducted; thus;—

"The field was not again watered until the evening of the 12th July or 5 days after it had been sown, when water to a depth of one inch was let on. From this day forth the young crop was watered twice a day, except when it rained. By the 10th of October, or just about 3 months after the seed was sown, the crop had attained its growth and came into full ear. From the 27th of October the field was only watered every alternate day to the depth of an inch; from the 6th of November no further irrigation was required as the crop was near maturity."

"The land was irrigated on each day of ploughing, that is, on four days inclusive of the day of sowing. The water was not again let on until the plants appeared above the surface which was on the third day. From that time until the crop was ripe, water was daily supplied to a uniform depth of 2 to 3 inches, but it is impossible to speak with more precision than this, because the supply over the whole field would not be uniform, that portion adjoining the channel receiving more water than that more remote."

"Water was applied daily at the rate of 2 to 3 inches in depth."

"The crop was watered every alternate day for a week after that until the harvest; there was always 1 inch of water on the land."

The next extract refers to a successful experiment made on the Sydapet Farm with a *minimum* quantity of water, on land which had not previously been under paddy:—

"During the growth of this crop the ground was watered 22 times, each time with a quantity equal to a rainfall of 1½ inches; the rainfall during 93 days from planting to reaping amounted to 14·81 inches, making the total quantity of water used nearly 48 inches, but fully one-third of the rainfall was lost, from it having fallen when not required."

Several of the Experimenters report that, from their, experience, the Carolina paddy seemed to require much less water than the ordinary country paddy. One wrote :—

"After transplanting, water was allowed to reach to one-third the height of the plants, but this was found not to suit as the plants turned unhealthy and of a yellowish color; the water was then withdrawn and allowed in quantity merely sufficient to keep the ground thoroughly moist. The appearance of the crop improved directly the excess of water was removed."

"The crop was cultivated in the usual way, but failed evidently from over-watering."

"I am inclined to attribute the small yield of Carolina paddy * * * to two causes—first, water was distributed in equal proportion to each crop (Carolina and country paddy) and the Carolina when I saw it appeared to have had almost too much water."

On comparing the practices here described with the practice common in America in irrigating paddy land, *vide* the "Notes" at the end of this report, it will be seen what a wide difference there is. In America, during the time the crop is growing, 150 days, the land cropped is under water only for about 68 days; while, there are two intervals each, of more than one month in which, the crop is dealt with as a dry crop. In this country, under ordinary circumstances, a month of dry tillage would prove fatal to a crop of country paddy and probably, to a crop of Carolina paddy also, except under very favorable circumstances.

19. Except an occasional weeding, the experimental crops received little attention during growth. The practice of hoeing appears to be almost unknown. But, in one or two Districts, notably in Nellore, the soil was loosened, between the rows of plants, by means of a light Country plough. The almost entire absence of tillage operations on the land while the Carolina paddy plants were growing is, undoubtedly, one reason why in some experiments the results were unsatisfactory. But, tillage during growth is possible, only on soils on which the plants are growing in lines, and this with paddy, is but rarely the case in this Presidency.

Observations made during the growth of the crop and, at harvest.

20. The Carolina paddy generally came into ear at from 10 to 12 weeks after the date of sowing. From many localities complaints were made that all the ears did not mature at the same time, thus making the harvesting of the crop, in a satisfactory way, a difficulty ; however, there are equally as many reports in which it is stated that the plants did not shed their seed nearly as readily as do plants of the indigenous varieties of paddy. Hence, if the harvesting was delayed, in order to allow time for the ripening of the backward ears, there was no loss from the shedding of the seed, and, the drawback experienced in the delay of the harvesting operations, is not felt in any deterioration of the straw, as is usual with country paddy, for the Experimenters generally agree, that the grain is always ripe, long before the straw. It was observed that crops raised from seed, matured ten days earlier than crops raised from transplanted plants, the produce of seed sown at the same time. This result, was attributed to the check in growth the plants usually suffered from on being transplanted. Excepting in the time in reaching maturity there was but little perceptible difference, in the crops produced from seed and from transplanted seedlings, when grown under similar conditions.

Transplanted crops longer in reaching maturity than sown crops.

21. The Carolina paddy plants on many of the experimental plots appear to have been unusually unfortunate in attracting such destructive foes as locusts, hares, &c. From one report the following interesting extract is taken :—

"All at once, and this is the strangest part of my story, the Carolina was attacked by locusts which, while leaving unharmed all the country paddy around, deliberately destroyed the Carolina paddy down to the ground."

It may be that the succulent robust growth of this paddy, which all Experimenters admit, afforded a more juicy stem, and therefore a more attractive food than the culms of the country paddy.

Ears of Carolina paddy heavy.

22. The ears of the Carolina paddy were reported, in many instances, to be from one-third to one-half heavier than those of country paddy grown under similar conditions. The average number of grains in an ear varied from 150 to 200, while many plants had from 10 to 12 fertile ears. One Reporter wrote :—

"I plucked indiscriminately a quantity of three kinds of paddy that were growing side by side. The following is the average number of grains on a single stalk of each :—Carolina 210 grains, Car paddy 101 grains, Sembalay 94 grains. I also observed that the Carolina grains stick very closely to the ears."

The Collector of Cuddapah, reported as follows :—

"I was present at the time of reaping and was surprised to see that the outturn was double that obtained from an equal extent of similar land cropped with country paddy. The stalks stood erect, were stronger and thicker, and obtained the uncommon height of from 4 to 5 feet."

The Produce.

Difficulty of separating the grain in threshing.

23. Many of the Experimenters, noticed the difficulty that was experienced in separating the grain in threshing. One wrote ;—

"When the sheaves were threshed it took 8 or 9 strokes to shake off the grain, whereas for the ordinary country paddy I am informed four strokes suffice."

The reports agree generally, as to the uniform size of the grain and, its freedom from the thin shrivelled grain which, in samples of country paddy forms such a considerable percentage.

24. The threshing was usually performed by striking the sheaves on a log of wood, the way in which country paddy is threshed. The difficulty with which the grain is separated, is not a fault, as some suppose. It is certainly true, that more labor must be expended in threshing Carolina than country paddy, the grain of the latter separates so easily, *too easily for the Ryot's interests*, for, even with the greatest care, a considerable quantity of its grain is always shed in the field during the harvesting operations. Carolina paddy, is not more difficult to thresh than other cereals; it is certainly much more easily threshed than oats or barley.

Quality of the straw.

25. Regarding the quality of the straw opinions varied greatly ;—

"The straw was for the most part strong and well grown, thicker, and stouter than the straw of indigenous varieties of paddy, and the Ryots themselves say that it would be more valuable as fodder for cattle."

"On some of the experimental plots the straw was of an extraordinary length."

"The straw is undoubtedly coarser and the cattle do not eat it so freely as the straw of the ordinary country paddy."

On this subject the Collector of Coimbatore wrote ;—

"While appreciating the larger yield of grain the Ryots take objection to the quality of the Carolina paddy straw. They said that the cattle would not eat it, and certainly my cattle refused it, but this, I think, was in consequence of its having been rather musty."

It is unlikely that cattle, that so readily eat the hard reedy straw of Cholum and Cumboo, will refuse the straw of Carolina paddy, when it is in a fresh state. When the cattle have refused it, the probability is, that the straw was, as noticed in the preceding extract, musty and unpalatable. Regarding the strength of the straw, the Superintendent of Government Farms, in reviewing some reports on the cultivation of Carolina paddy, wrote ;—

The strength of the straw of Carolina Paddy is an advantage.

"The strength of the straw objected to by some Ryots is a valuable characteristic of the Carolina paddy plant; it enables the crop to withstand the effects of rough weather. Storms which would prostrate crops of country paddy pass over crops of Carolina paddy harmlessly."

26. The yield of grain and of straw, from the Carolina paddy experimental plots, varied greatly, as the following statement shows :—

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY.

Number of Experiment.	Taluq or Village	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.*			LBS.	MADRAS MEASURES.*	LBS.	FEET.	LBS.	MADRAS MEASURES.*	LBS.
	SOUTH ARCOT DISTRICT.												
	Trickalore Taluq.												
1	Trickalore	22,400	270	..	5th September ..	..	11,564	..	18,540	4½	2,499	..	4,006
2	Do.	5,324	75	..	27th do. ..	21st February ..	1,845	..	..	2½	1,677	..	..
3	Do.	3,338	60	..	27th do. ..	21st do. ..	787	..	1,128	2½	1,142	..	1,636
4	Do.	6,000	73	..	18th October ..	24th do. ..	1,150	..	1,875	2½	928	..	1,512
5	Do.	6,400	62	..	14th September ..	1st do. ..	1,089	..	2,000	2½	824	..	1,512
6	Do.	1,600	26	..	14th do. ..	8th do. ..	220	..	500	2½	665	..	1,512
	CHINGLEPUT DISTRICT.												
	Sydapet Taluq.												
7	Sydapet	980	10	5	22nd September ..	10th January ..	358	168	1,092	4	1,768	830	5,393
8	Do.	1,113	30	..	21st December ..	16th April ..	290	..	804	..	1,261	..	3,496
	Chingleput Taluq.												
9	Nattam..	1,867	..	5	3rd September ..	7th January ..	528	200	..	..	1,368	518	..
10	Do.	1,600	..	6	14th do. ..	20th do. ..	254	96	..	..	768	290	..
11	Melmayur	800	10	4	24th September ..	6th February ..	157	60	..	..	949	..	..
	Madranticum Taluq.												
12	Madranticum	2,667	..	5.	19th November ..	28th March ..	491	186	..	..	891	388	..
13	Penayur	2,400	10	4	31st December ..	3rd May ..	315	120	..	..	635	..	..

	Trivellore Taluq.												
14	Nagalapuram ..	720	12	..	1st October ..	..	156	..	337	2½	1,050	..	2,269
15	Palavacum	800	25	..	11th August ..	8th January ..	125	..	..	3	756	..	..
	North Arcot District.												
	Chittoor Taluq.												
16	Chittoor	1,600	17	6	..	19th March ..	690	240	..	..	2,087	..	..
17	Do.	3,200	25	9	..	9th April ..	991	345	..	..	1,499	..	..
18	Do.	800	12	..	7th July ..	12th November ..	246	..	..	..	1,488	..	..
	Vellore Taluq.												
19	Agram	267	..	6	1st September ..	25th February ..	108	..	..	..	1,957	..	..
	Arcot Taluq.												
20	Visharam	1,067	..	8	..	..	356	109	..	..	1,615	..	..
	Madras District.												
21	Madras..	2,700	61	..	19th September ..	20th January ..	300	..	710	..	538	..	1,273
	Nellore District.												
	Rapur Taluq.												
22	Rapur	532	17	..	15th October ..	29th February ..	178	..	600	3	1,619	..	5,458
23	Do.	774	17	..	Do. ..	Do. ..	105	..	360	3	657	..	2,251
	Polur Division.												
24	Naidupett	391	10	..	17th September ..	16th January ..	79	..	..	3¼	988	..	..
25	Agraharapett	7,259	127	..	20th do. ..	22nd do. ..	1,223	..	..	3	815	..	..
26	Do.	2,961	42	..	20th do. ..	27th do. ..	260	..	..	3	426	..	..
27	Vinnamala	890	13	..	20th August ..	2nd January ..	75	..	..	3¼	410	..	..

104 Cubic Inches, or, 0468 of an Imperial Bushel.

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
					NELLORE DISTRICT—(*Continued*).								
	Venkatagherry Division.												
28	Menakoor	1,504	34	..	3rd November ..	23rd March ..	231	..	425	..	745	..	1,367
	Kavali Taluq.												
29	Kavali	1,452	11	..	1st September ..	30th December ..	180	..	..	3	600	..	..
	Nellore Taluq.												
30	Nellore	5,857	76	..	11th do. ..	23rd January ..	672	..	1,440	2	555	..	1,189
					KISTNA DISTRICT.								
	Bezwada Taluq.												
31	Velagaleru	284	28	..	1st August ..	26th December ..	150	..	..	3	2,556	..	..
32	Vamavaram	1,306	14	..	9th do. ..	December ..	480	..	..	..	1,779	..	..
33	Do.	1,307	10	..	7th September ..	January ..	360	..	..	..	1,333	..	..
34	Kankipad	2,130	16	..	6th and 7th August	December ..	442	..	..	..	1,004	..	..
35	Do.	2,130	12	..	7th September ..	Do. ..	332	..	..	..	755	..	..
	Nandegama Taluq.												
36	Anumanchepalli ..	387	22	..	July	1st January ..	168	..	..	..	2,101	..	..
37	Do. ..	726	22	..	Do.	Do. ..	168	..	..	..	1,120	..	..
38	Jaggiapett	1,113	18	..	Do.	November ..	354	..	..	..	1,539	..	..
39	Panugancheprole ..	1,113	57	..	August	December ..	318	..	..	..	1,383	..	..

40	Do. ..	1,210	16	..	Do.	Do. ..	242	..	..	..	970	..	..
	Bapatla Taluq.												
41	Guntur Peta Mangalageri.	3,560	30	..	1st September ..	30th December ..	1,306	..	3,200	3	1,775	..	4,350
42	Chebrole	2,400	21	..	20th July	21st November ..	360	..	700	3	726	..	1,411
43	Do.	2,594	21	..	Do.	Do. ..	277	..	692	3	518	..	1,291
44	Marripoody	9,680	112	..	..	..	960	..	..	..	480	..	..
	Repalli Taluq.												
45	Addepalli	532	16	..	12th August ..	28th December ..	150	..	230	2¼	1,365	..	2,093
46	Battiprolu	1,210	34	..	..	..	180	..	..	..	720	..	..
47	Chandarole	2,420	50	..	..	..	240	..	..	..	480	..	..
	Palnad Taluq.												
48	Pinnali	2,420	60	..	..	..	520	..	..	..	1,040	..	..
	Vallur Zemindary.												
49	Boddapad	3,775	72	..	..	..	480	..	..	..	615	..	..
						GODAVERY DISTRICT.							
	Rajahmundry Taluq.												
50	Raghudevapuram ..	6,788	40	..	12th July	13th November ..	1,640	..	..	4½	1,169	..	..
51	China Kondepudy ..	10,264	48	..	3rd do.	15th do. ..	1,640	..	..	4	773	..	..
52	Stikayalapalli	4,444	40	..	1st do.	2nd December ..	640	..	..	3	697	..	..
	Tanuku Taluq.												
53	Tanuku..	9,680	50	..	1st do.	20th November ..	1,500	..	..	3¾	750	..	..
	Yernagudem Taluq.												
54	Chagallu	1,210	12	..	11th do.	24th do. ..	156	..	650	..	624	..	2,600
						VIZAGAPATAM DISTRICT.							
	Palcondah Taluq.												
55	Vadamah	4,000	130	..	21st July	17th November ..	1,209	..	2,500	2½	1,462	..	3,025
56	Palcondah	..	50	..	..	..	563	..	..	..	..	..	..

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES	LBS.	FEET.	LBS.	MADRAS MEASURES	LBS.
	VIZAGAPATAM DISTRICT—(*Continued*).												
	Vizianagaram Zemindary.												
57	Gunupur	26	..	..	..	..	275	..	..	..	..	..	..
58	Do	18	..	..	..	..	120	..	..	..	..	..	..
	GANJAM DISTRICT.												
	Aska Taluq.												
59	Aska	..	50	..	4th July ..	9th November ..	803	..	..	..	..	..	..
60	Do.	..	50	..	4th do. ..	Do. ..	680	..	..	..	..	..	..
61	Do.	..	16	..	27th do. ..	4th December ..	255	..	..	..	..	..	..
62	Do.	..	15	..	27th do. ..	Do. ..	233	...	..	..	..	..	..
	KURNOOL DISTRICT.												
	Koilkuntla Taluq.												
63	Boyalatadiparti ..	726	17	..	17th July.. ..	20th December ..	608	..	1,248	..	4,053	..	8,320
64	Vuppalur	2,480	85	..	18th August ..	11th do. ..	1,296	..	..	..	2,529	..	..
65	Timmanayanipettah ..	1,210	56	..	6th do. ..	10th do. ..	532	..	1,296	..	2,128	..	5,184
66	Tollamadugu	2,541	78	..	29th do. ..	15th do. ..	984	..	..	..	1,874	..	..
67	Hanumantagundum ..	1,161	17	..	8th do. ..	1st do. ..	351	..	..	..	1,465	..	..
68	Timmanayanipettah ..	1,391	54	..	26th do. ..	20th do. ..	372	..	..	..	1,294	..	..
69	Owk	2,057	54	..	14th September ..	18th January ..	510	..	..	..	1,200	..	..
	Nundial Taluq.												
70	Nundial	726	51	..	10th August ..	2nd December ..	324	..	528	3	2,166	..	3,520

71	Do.	3,509	125	.	28th July ..	28th November ..	1,276	..	4,320	..	1,761	..	5,959
72	Do.	1,210	28	..	18th do. ..	3rd December ..	376	..	..	2¾	1,505	..	..
73	Do.	1,597	47	..	5th August ..	20th do. ..	456	..	..	..	1,382	..	..
74	Do.	1,210	28	..	12th do. ..	29th November ..	342	..	..	..	1,368	..	..
75	Do. ..	1,597	35	..	26th July ..	26th do. ..	380	..	528	..	1,152	..	1,600
76	Do.	387	10	..	5th August ..	20th December ..	61	..	..	..	772	..	..
	Nandikotkur Taluq.												
77	Bizinivemula	968	22	..	13th August ..	26th December ..	446	..	..	..	2,233	..	..
78	Nandikotkur	726	17	..	12th do. ..	31st do. ..	247	..	..	..	1,647	..	..
79	Bizinivemula	2,226	35	..	13th do. ..	26th do. ..	674	..	..	..	1,467	..	..
80	Damagatla	968	16	..	5th do. ..	15th do. ..	216	..	..	3	1,080	..	..
81	Vaddemanu	5,337	92	..	27th do. ..	25th do. ..	1,160	..	1,500	3	1,052	..	..
82	Do.	1,452	16	..	13th do. ..	26th do. ..	266	..	..	..	887	..	..
	Patticondah Taluq.												
83	Bondimadugula ..	242	14	..	20th July ..	26th December ..	141	..	..	..	2,835	..	..
84	Jilladubudakala ..	1,210	48	..	5th August ..	4th January ..	480	..	..	4	1,920	..	..
85	Kotakonda	968	24	..	20th do. ..	19th do. ..	240	..	..	4	1,200	..	..
86	Karivemula	4,477	120	..	5th September ..	4th February ..	912	..	..	4	986	..	..
	Ramalkota Taluq.												
87	Yeldurty	1,210	30	..	2nd August ..	4th December ..	513	..	..	..	2,052	..	..
88	Do.	1,815	35	..	3rd October ..	..	622	..	..	..	1,659	..	..
89	Vudumalpad	4,840	77	..	9th August ..	5th December ..	885	..	..	3	885	..	..
90	Sudapalli	9,680	135	..	2nd September ..	..	1,230	..	..	3	615	..	..
	Sirwell Taluq.												
91	Chagalmarry	484	18	..	14th August ..	28th December ..	266	..	312	..	2,660	..	3,120
92	Do.	1,597	11	..	2nd do. ..	..	648	..	..	..	1,965	..	..
93	Do.	2,613	38	..	15th do. ..	28th December ..	484	..	..	..	897	..	..
	Markapur Taluq.												
94	Chapalamadugu ..	..	12	..	12th August ..	10th January ..	64	..	..	..	..	..	..
95	Yerragoodapallem ..	..	12	..	20th do. ..	3rd do. ..	78	..	..	..	..	..	..
96	Tripurantakum ..	..	6	..	12th do. ..	10th do. ..	72	..	..	..	..	..	..
97	Kowlacoontla	..	6	..	12th do. ..	10th do. ..	36	..	..	..	..	..	..

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
			Weight.	Measure.			Grain threshed.		Straw.		Grain threshed.		Straw.
							Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
					KURNOOL DISTRICT—(*Continued*).								
	Cumbum Taluq.												
98	Yerrabollem	..	26	..	8th September ..	10th February ..	178	..	..	..	..	..	..
					BELLARY DISTRICT.								
	Hospett Taluq.												
99	Mudalapuram	1,540	28	..	2nd August ..	1st January ..	570	..	1,293	6	1,791	..	4,066
100	Hossoor	242	14	..	20th July	10th December ..	80	..	..	4	1,600	..	..
101	Hullirampuram ..	302	12	..	10th June ..	30th November ..	80	..	..	4	1,282	..	..
102	Kamalapoor	14,520	100	..	14th August ..	25th December ..	3,162	..	..	3	1,054	..	..
103	Do.	..	14	..	20th do. ..	28th January ..	242	..	324	3	..	..	..
104	Chitwadgi	514	12	..	5th July ..	25th November ..	110	..	..	3	1,036	..	..
105	Basapuram	605	12	..	1st August ..	30th do. ..	80	..	120	3	640	..	960
	Anantapur Taluq.												
106	Singanamulla	1,815	42	..	4th August ..	6th January ..	1,033	..	..	4½	2,755	..	..
107	Do.	1,815	42	..	4th do. ..	10th do. ..	944	..	..	3¾	2,519	..	..
108	Bookarungasamudrum.	3,630	36	..	22nd do. ..	20th December ..	820	..	..	3	1,093	..	..
109	Anantapur	605	16	..	22nd September ..	4th February ..	131	..	..	3	1,049	..	..
	Bellary Taluq.												
110	Moka	3,388	19	..	23rd August ..	12th January ..	280	..	..	2½	400	..	..
	Huvinhadgally Taluq.												
111	Dombarahully ..	..	31	..	23rd August ..	14th December ..	508	..	500	3	..		

	CUDDAPAH DISTRICT.												
	Madanapully Taluq.												
112	Kollapalli	3,630	92	..	17th January ..	23rd May ..	1,794	..	..	5	2,392	..	..
113	Do.	3,630	92	..	5th do. ..	18th do. ..	1,776	..	..	5	2,368	..	..
114	Do.	1,694	43	..	5th do. ..	16th June ..	388	..	..	5	1,109	..	..
	Cuddapah Taluq.												
115	Cuddapah	5,445	90	..	26th September ..	30th January ..	1,187	..	..	..	1,055	..	..
116	Do.	13,373	261	..			2,802	..	..	..	1,014	..	..
	MALABAR DISTRICT.												
	Polghaut Taluq.												
117	Akatetara	225	12	..	22nd May ..	20th October ..	148	..	..	..	3,184	..	..
118	Koppam	1,600	50	..	25th June ..	..	740	..	..	..	2,238	..	..
119	Aktethara	2,200	90	..	5th May ..	25th September ..	900	..	..	..	1,980	..	..
120	Do.	596	26	..	15th do. ..	18th October ..	227	..	..	3	1,847	..	..
121	Kattuseri	300	10	..	20th do. ..	20th October ..	54	..	150	4½	871	..	2,420
122	Puduchary	1,100	21	..	27th June ..	9th November ..	133	..	..	3	585	..	..
	Cherakal Taluq.												
123	Puyadi	698	16	..	..	20th October ..	255	..	..	3½	1,768	..	..
124	Kuttoor	1,800	45	..	28th May	28th do. ..	540	..	..	3	1,452	..	..
125	Kalliad Amshom ..	2,640	51	..	16th May ..	4th do. ..	768	..	..	5	1,409	..	..
126	Kalliad	3,324	46	..	22nd May ..	15th do. ..	599	..	..	5	873	..	..
127	Do.	2,300	44	..	17th do. ..	5th do. ..	224	..	..	..	433	..	..
	Kottayam Taluq.												
128	Perinkolam	560	16	..	8th June ..	7th do. ..	113	..	85	4	983	..	..
129	Do.	1,464	42	..	18th May ..	10th do. ..	240	..	..	5	793	..	..
	Wynaad Taluq.												
130	Ellornad	188	10	..	10th June ..	28th November ..	95	..	114	2	2,446	..	2,935

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES	LBS.	FEET.	LBS.	MADRAS MEASURES	LBS.
					KURNOOL DISTRICT—(*Continued*).								
	Cumbum Taluq.												
98	Yerrabollem	..	26	..	8th September ..	10th February ..	178	..	..	..	..	..	..
					BELLARY DISTRICT.								
	Hospett Taluq.												
99	Mudalapuram	1,540	28	..	2nd August ..	1st January ..	570	..	1,293	6	1,791	..	4,066
100	Hossoor	242	14	..	20th July	10th December ..	80	..	..	4	1,600	..	..
101	Hullirampuram ..	302	12	..	10th June ..	30th November ..	80	..	..	4	1,282	..	..
102	Kamalapoor	14,520	100	..	14th August ..	25th December ..	3,162	..	..	3	1,054	..	..
103	Do.	..	14	..	20th do. ..	28th January ..	242	..	324	3	..	..	..
104	Chitwadgi	514	12	..	5th July ..	25th November ..	110	..	..	3	1,036	..	..
105	Basapuram	605	12	..	1st August ..	30th do. ..	80	..	120	3	640	..	960
	Anantapur Taluq.												
106	Singanamulla	1,815	42	..	4th August ..	6th January ..	1,033	..	..	4½	2,755	..	..
107	Do.	1,815	42	..	4th do. ..	10th do. ..	944	..	..	3¾	2,519	..	..
108	Bookarungasamudrum.	3,630	36	..	22nd do. ..	20th December ..	820	..	..	3	1,093	..	..
109	Anantapur	605	16	..	22nd September ..	4th February ..	131	..	..	3	1,049	..	..
	Bellary Taluq.												
110	Moka	3,388	19	..	23rd August ..	12th January ..	280	..	..	2½	400	..	..
	Huvinhadgally Taluq.												
111	Dombarahully		31	..	23rd August ..	14th December ..	508	..	500	3	..	..	..

CUDDAPAH DISTRICT.

	Madanapully Taluq.												
112	Kollapalli	3,630	92	..	17th January ..	23rd May ..	1,794	..	..	5	2,392	..	..
113	Do.	3,630	92	..	5th do. ..	18th do. ..	1,776	..	..	5	2,368	..	..
114	Do.	1,694	43	..	5th do. ..	16th June ..	388	..	..	5	1,109	..	..
	Cuddapah Taluq.												
115	Cuddapah	5,445	90	..	26th September ..	30th January ..	1,187	..	..	..	1,055	..	..
116	Do.	13,373	261	..		..	2,802	..	..	..	1,014	..	..

MALABAR DISTRICT.

	Palghaut Taluq.												
117	Akatetara	225	12	..	22nd May ..	20th October ..	148	..	..	..	3,184	..	..
118	Koppam	1,600	50	..	25th June ..	..	740	..	..	..	2,238	..	..
119	Aktethara	2,200	90	..	5th May ..	25th September ..	900	..	..	..	1,980	..	..
120	Do.	596	26	..	15th do. ..	18th October ..	227	..	..	3	1,847	..	..
121	Kattuseri	300	10	..	20th do. ..	20th October ..	54	..	150	4½	871	..	2,420
122	Puduchary	1,100	21	..	27th June ..	9th November ..	133	..	..	3	585	..	..
	Cherakal Taluq.												
123	Puyadi	698	16	..	..	20th October ..	255	..	..	3½	1,768	..	..
124	Kuttoor	1,800	45	..	28th May	28th do. ..	540	..	..	3	1,452	..	..
125	Kalliad Amshom ..	2,640	51	..	16th May ..	4th do. ..	768	..	..	5	1,409	..	..
126	Kalliad	3,324	46	..	22nd May ..	15th do. ..	599	..	..	5	873	..	..
127	Do.	2,300	44	..	17th do. ..	5th do. ..	224	..	..	..	433	..	..
	Kottayam Taluq.												
128	Perinkolam	560	16	..	8th June ..	7th do. ..	113	..	85	4	983	..	..
129	Do.	1,464	42	..	18th May ..	10th do. ..	240	..	..	5	793	..	..
	Wynaad Taluq.												
130	Ellornad	188	10	..	10th June ..	28th November ..	95	..	114	2	2,446	..	2,935

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed Sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
					MALABAR DISTRICT—(*Continued*).								
	Ponany Taluq.												
131	Ishwaramangalam ..	1,360	10	..	13th April ..	10th September ..	291	..	494	3	1,036	..	1,759
					SOUTH CANARA DISTRICT.								
	Kasargod Taluq.												
132	Kalliyar village in Nileshwar Mogni ..	2,420	16	..	20th June ..	17th October ..	624	..	1,248	3½	1,248	..	2,497
133	Kottur village in Kavenad Mogni ..	2,420	15	..	24th do. ..	20th do. ..	624	..	1,248	4	1,248	..	2,496
134	Kodoth village in Paduvannad Mogni ..	3,388	32	..	18th June ..	16th do. ..	528	..	1,056	4	754	..	1,509
	Uppinangadi Taluq.												
135	Kadikar village ..	993	15	..	17th June ..	20th October ..	287	..	..	2	1,399	..	..
136	Do. ..	859	14	..	Do. ..	28th do. ..	106	..	..	2	597	..	..
	Udipi Taluq.												
137	Mudindambur village, Nidambur Magane ..	950	16	..	12th May ..	9th October ..	320	..	680	5	1,630	..	3,464
	Mangalore Taluq.												
138	Codiyalbail	3,267	99	..	20th & 24th June.	15th October ..	504	..	..	3	747	..	..

COIMBATORE DISTRICT.

	Coimbatore Taluq.												
139	Coimbatore	960	28	..	4th July ..	..	769	..	500	2	3,877	..	2,521
140	Oodanthoray	2,280	120	..	14th August ..	26th December ..	1,308	..	860	4	2,776	..	..
141	Coimbatore	600	12	..	5th September ..	22nd January ..	287	..	400	5	2,319	..	3,227
142	Do.	600	25	..	29th August ..	22nd do. ..	262	..	..	5	2,117	..	..
143	Do.	600	25	..	Do. ..	22nd do. ..	192	..	300	3¼	1,553	..	2,420
144	Do.	600	12	..	5th September ..	22nd do. ..	167	..	250	3¼	1,351	..	2,017
145	Do.	1,920	75	..	8th August ..	21st do. ..	525	..	937	2½	1,323	..	2,362
146	Chittarachavady ..	1,280	23	..	28th June ..	30th October ..	258	..	625	3	976	..	2,363
147	Odanthoray	4,000	78	..	23rd August ..	26th December ..	450	..	..	3	544	..	..
	Darapuram Taluq.												
148	Darapuram	100	13		7th July ..	..	67	..	..	3	3,243	..	..
149	Do.	400	23	..	31st do. ..	22nd November ..	194	..	..	3	2,347	..	..
150	Do.	400	11	..	15th September ..	14th January ..	172	..	..	..	2,081	..	..
151	Do.	700	33	..	14th June ..	24th October ..	253	..	..	3	1,749	..	..
152	Do.	400	13	..	27th November ..	4th April ..	108	..	..	2	1,307	..	..
153	Do.	400	13	..	7th August ..	..	97	..	..	3	1,174	..	..
154	Do.	600	16	..	5th July	..	140	..	..	3	1,129	..	..
155	Do.	700	27	..	18th June ..	27th October ..	162	..	..	3	1,120	..	..
156	Do.	400	13	..	16th July	8th November ..	81	..	..	3	980	..	..
	Pollachy Taluq.												
157	Marchinaigompolliem.	387	12	..	1st June ..	9th December ..	350	..	125	3	4,377	..	..
158	Anamallay	2,129	50	..	3rd May ..	..	1,500	..	..	3¾	3,410	..	..
159	Do.	532	20	..	20th July ..	27th December ..	300	..	200	3	2,729	..	..
160	Sunthagoundenpolliem.	3,193	100	..	15th do.	1st November ..	1,650	..	1,500	3	2,501	..	..
161	Do. ..	532	12	..	15th August ..	1st December ..	250	..	150	3	2,274	..	1,365
162	Marchinaigompolliem..	581	10	..	2nd January ..	9th May	235	..	150	3	1,958	..	..
	Sathiamungalum Taluq.												
163	Vaniputtur	1,600	20	..	2nd September ..	26th January ..	512	..	570	4½	1,549	..	..
164	Poodooparlyur ..	1,600	20	..	18th do. ..	2nd February ..	396	..	494	4½	1,198	..	..
165	Vaniputtur	600	15	..	29th do. ..	February ..	96	..	150	2¼	774	..	1,210
166	Puliyampattykarai ..	400	10	..	3rd October ..	10th February ..	64	..	100	2¼	774	..	1,210

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed Sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES	LBS.	FEET.	LBS.	MADRAS MEASURES	LBS.
					COIMBATORE DISTRICT—(*Continued*).								
	Oodumalapetta Taluq.												
167	Komaralingum ..	8,800	290	..	10th August ..	13th December ..	2,862	..	..	3	1,574	..	..
168	Do.	605	14	..	7th do. ..	3rd December ..	195	..	105	3¾	1,560	..	..
169	Valayapalayam ..	605	12	..	6th December ..	20th May ..	114	..	75	3	916	..	..
	Perindoray Taluq.												
170	Nunjakalambady ..	320	21	..	4th October ..	1st March ..	288	..	..	3¾	4,356	..	..
171	Dalavoypolliem ..	448	12	..	1st do. ..	4th February ..	330	..	600	4½	3,565	..	..
	Caroor Taluq.												
172	Neroor	1,600	27	..	18th November ..	28th April ..	216	..	393	3	653	..	1,189
					SALEM DISTRICT.								
	Trichengode Taluq.												
173	Coondelputty	968	12	..	Early part of July.	..	768	..	1,500	4½	3,840	..	7,500
174	Mattooputty	3,630	24	..	Early part of Aug.	..	1,843	..	3,750	4½	2,458	..	5,000
175	Comaramangalam ..	2,120	19	..	Early part of July.	..	230	..	450	3½	526	..	1,027
	Namkal Taluq.												
176	Mothalaiputty	1,210	24	..	1st October ..	20th January ..	405	..	..	4½	1,620	..	..
177	Kosavamputty	1,210	24	..	10th do. ..	10th February ..	337	..	..	5	1,350	..	..
178	Do.	605	18	..	5th do. ..	February ..	135	..	..	5	1,080	..	..

TANJORE DISTRICT.

	Tanjore Taluq.												
179	Nadukávèri	3,200	120	..	10th June ..	22nd October ..	1,995	..	..	..	3,017	..	..
180	Kulimâttur	2,160	80	..	11th do. ..	21st do. ..	1,250	..	..	..	2,801	..	..
181	Tiruppayanam ..	2,080	78	..	15th do. ..	26th do. ..	986	..	..	..	2,295	..	..
182	Daivastanam Tingalore.	480	26	..	1st do. ..	30th do. ..	151	..	..	..	1,523	..	..
183	Mokasakarkudi ..	5,920	161	..	26th June ..	30th October ..	1,852	..	..	..	1,514	..	..
184	Kaduveli	3,200	75	..	25th August ..	30th December ..	700	..	..	..	1,059	..	..
185	Vencatasasamudram ..	2,080	60	..	22nd June ..	29th October ..	420	..	..	..	977	..	..
186	Vaurankudi	1,570	56	..	20th July ..	12th December ..	309	..	..	..	953	..	..
187	Perumpuliyar ..	2,420	37	..	1st October ..	26th January ..	237	..	..	..	474	..	..
	Combaconum Taluq.												
188	Palaiyarukai	4,800	196	..	22nd June ..	25th October ..	2,205	..	..	..	2,223	..	..
189	Perumpadi	2,240	111	..	20th July ..	5th December ..	913	..	..	..	1,975	..	..
190	Sembangudi	1,600	111	..	3rd do. ..	12th November ..	650	..	..	..	1,966	..	..
191	Runganathapuram ..	2,016	78	..	22nd June ..	15th November ..	748	..	..	..	1,796	..	..
192	Nermelikudi	4,000	157	..	20th June ..	6th October ..	1,024	..	..	..	1,239	..	..
193	Veppattur	3,200	78	..	23rd July ..	19th December ..	406	..	..	..	615	..	..
	Mannargudi Taluq.												
194	Mannargudi	822	98	40	..	..	492	200	..	..	2,897	1,178	..
	Trivadi Taluq.												
195	Trivadi	1,200	50	20	12th June ..	1st October ..	608	247	..	..	2,452	996	..

TRICHINOPOLY DISTRICT.

	Perambalur Taluq.												
196	Perambalur	242	12	4	9th September ..	6th February ..	150	..	..	..	3,000	..	..
	Woodiarpolliam Taluq.												
197	Arealúr	4,840	58	..	15th July ..	7th December ..	1,360	..	..	3½	1,360	..	..

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed Sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
					TRICHINOPOLY DISTRICT—(*Continued*).								
	Trichinopoly Taluq.												
198	Koohur	4,840	120	..	9th September ..	6th February ..	1,224	..	..	..	1,224	..	..
	Musery Taluq.												
199	Musery	1,691	33	..	19th August ..	2nd January ..	171	..	400	2¼	489	..	1,143
					MADURA DISTRICT.								
	Pulney Taluq.												
200	Pulney	355	46	..	6th October ..	21st March ..	231	..	..	3	3,149	..	..
201	Iyempully	355	27	10	5th October ..	2nd Februay ..	146	54	..	..	2,004	..	..
202	Thamaraycolum ..	711	27	10	11th September ..	29th January ..	293	108	..	..	2,001	..	..
	Dindigul Taluq.												
203	Balakistnapuram ..	966	30	..	4th September ..	20th do. ..	567	..	1,618	3¾	2,840	..	8,107
204	Seelapady	1,111	12	..	10th do. ..	10th February ..	540	..	..	4	2,352	..	..
205	Balakistnapuram ..	4,840	36	..	25th do. ..	1st do. ..	1,320	440	..	4	1,320	..	..
	Madura Taluq.												
206	Kolamungalum ..	622	16	6	4th October ..	25th do. ..	95	..	..	..	740	..	..

27. The foregoing statement, includes only the results of experiments that appeared to have been conducted under fair average conditions, and were on a scale sufficiently extensive to afford data of practical value. The difference in the results tabulated, must be attributed to the varying conditions of soil, irrigation, and tillage, under which they were obtained, and not, to any appreciable extent, to the climate of one part of the Presidency being more suited, than that of another part, for the growth of this variety of paddy. Though, there is a wide difference between the climate of South Carolina and, the climate of the Madras Presidency, this difference, does not appear to have influenced the growth of the paddy in this country, the results from acclimatized and, imported seed, having differed but little. Throughout the wide range of country over which the experiments were spread the yield, almost everywhere, was satisfactory when the proper conditions of soil and tillage were met with. The yield of grain per acre was, in several instances, higher than the average yield of an acre in South Carolina. It is true, that in the majority of the experiments the yield was unsatisfactory, but this applies equally to the country paddy crops reported on.

Over the country generally more poor crops than good crops.

The fact is, throughout the country, there are a much greater number of indifferent crops produced, than of good crops. It is only when the individual history of each crop is searched out and recorded, as was done in the case of most of the Carolina paddy experimental crops, that the fact, that there are so many bad crops raised, is brought into prominence. The following extract from a report by the Collector of Cuddapah affords information on this question :—

"The abundance of produce was, of course, proportionate to the fertility of the soil ; in regard to the little success that attended the efforts of a few Ryots in some localities, I have only to observe that it was owing to the sterility of the soil or to the crops having been destroyed by blight."

Yield good in several instances.

28. In some instances the general results of the experiments were very satisfactory : thus ;—

"The outturn exceeded by one-third the average yield of the adjoining land under indigenous paddy."

"The yield he describes as treble that of the ordinary paddy, while the straw is half as high again."

The Collector of Malabar remarked :—

"Marked success attended the experiments in several instances ; the failures in a few, and want of success in others, is attributable to accidents, to which all crops are liable, as too much or, too little rain, attacks of insects, &c."

The Collector of North Arcot wrote :—

"The result of the experiment I consider to be most satisfactory and proves that the Carolina paddy is a cereal well suited to this country which thrives splendidly without requiring more skill or care in the cultivation than the commonest grain."

The Dewan of the Travancore State wrote :—

"From the result of the experiment we may, I think, safely conclude that the soil of Travancore especially in the Northern Districts is well adapted to the growth of the new species of paddy, the grains of which are decidedly superior in quality to the common produce of the country."

Quality of the rice.

29. There is a considerable difference, in the opinions expressed regarding the quality of the rice, of the Carolina paddy, raised in the experiments. Before proceeding to notice these opinions, it is as well to observe, that in the Madras Presidency nearly the whole of the rice, for local consumption and export, is prepared by the pestle and mortar, worked by women ; no machinery being used. The common practice, is to boil the paddy and, after the interval of a day or two, during which it is dried by exposure to the sun, to subject it to the husking operations. A considerable quantity of paddy is, however, husked without being boiled. The process of husking is very rude and tedious, and the rice has a very poor appearance, compared with that of rice prepared in rice mills. Imperfect though the process is, it is cheaper, than that by which rice is prepared in mills

in America. It is only in appearance, that the rice fails; for, this apparent defect, is an advantage from the consumer's point of view, for, in the effort to render the sample agreeable to the eye, the milling process removes from the rice some of its most nutritious portions, those in which the albuminoids are chiefly to be found.

30. The following extract, from an Annual Report of the Superintendent of Government Farms refers to two samples of rice, forwarded to England for valuation, being the produce of Carolina paddy produced on the Sydapet Experimental Farm :—

"89. Parcel A was prepared from 8 Madras measures of Carolina paddy and consisted of $3\frac{3}{4}$ Madras measures of clean rice. Messrs. Walker and Co. were good enough to have the paddy husked in the way that it is usual, in Madras, to husk all paddy, intended for export to England. The 8 measures of paddy, yielded as follows :—

	By volume. Per cent.
Clean rice fit for the Home market	46·87
Broken rice	3·13
Husk and wastage	50·00
Total	100·00

"With reference to this result, Messrs. Walker and Co. wrote to me :—'We are not very well satisfied as to the result of the husking; the grains are more broken than is desirable, but the coolies say they found it more difficult to husk the paddy than the ordinary native grain.' With reference to the cost of husking, they wrote :—'The cost of husking the 8 measures is 1 anna, and we can contract at this rate for all you intend sending to England. In the same letter they remarked : 'the wastage on this 8 measures may be taken as a fair average.'

"90. Parcel B consisted of 623 pounds of cleaned rice prepared from 448 Madras* measures of country-raised Carolina paddy. In addition to the clean rice there were $24\frac{3}{4}$ measures of broken rice, the value of which was, in Madras, one anna per measure.

"91. The following letter refers to parcel B :—

'DEAR SIR,—We now wait on you with our broker's report and valuation on the four bags of rice sent to London on your account by S.S. *Sultan*, and we trust the report will be considered satisfactory. We may mention that while your rice is valued at 10*s*. $4\frac{1}{4}$*d*. to 10*s*. 6*d*. per cwt., *ordinary* Pinky was sold at 9*s*. 6*d*. to 10*s*. $7\frac{1}{2}$*d*. for *good*.

(Signed) WALKER AND CO.

'*Broker's report on four bags* G.F. *of rice per "Sultan."*

W. & Co.

R.

'The rice proves to be very fine white grain, and in quantity would command 10*s*. $4\frac{1}{4}$*d*. to 10*s*. 6*d*.; it is different from what is known as Pinky, and we doubt if the starch-makers, who are the largest consumers of this particular sort, would like it so well, but for cleaning purposes it would meet a ready sale.'

"92. The rice was sold in London in the usual way; the price realized, 11*s*. 6*d*. per cwt., was only a trifle higher than the price ruling at the time for ordinary Madras rice. This result, was somewhat disappointing; judging from the value generally put upon Carolina rice in London, I had anticipated a much larger price than was obtained.

"93. It is, I think, probable that the very high price that Carolina rice imported from America commands in England is due chiefly to the very superior way in which it is prepared for market. The Madras-grown Carolina paddy, from which the rice (Parcel B) was prepared, was, as far as I can judge, quite equal in quality to the

* 104 cubic inches.

Carolina paddy which was imported into this country from America and which, was the seed from which the paddy in question was raised. In Madras, the husk merely is removed, there is no attempt to remove the dark-colored surface which is found immediately beneath, and very little is attempted in the way of sizing the grain, the whole process, such as it is, being performed by women by means of a pestle and mortar and a bamboo sieve."

31. Dr. Thompson, who made some interesting experiments in Chingleput and in Tinnevelly with Carolina paddy, gives the yield of rice, he obtained from Carolina paddy and two indigenous varieties of paddy as follows :—

—	Weight per Madras Measure.	Weight of Rice obtained.
	oz.	oz.
Manawari Sumba paddy ..	42·50	32
Car paddy	42·25	32
Carolina paddy	43·50	32·50

32. As regard the estimation in which the Carolina rice is held by Natives, the following extracts will afford information ;—

" I gave some of the paddy to Brahmins, and they informed me that there is less loss in removing the husk than in the ordinary paddy and that it is far superior as an article of food."

" The rice is far superior in color, size, and flavour to any of the country kinds that can be produced within the same short time ;"

" that the Carolina rice is superior to the best of the rice staples of the country is not now denied ;"

" the rice of Carolina paddy is decidedly much superior to that of the ordinary paddy ;"

" it is perfectly white in color and when dressed for food is of good taste. In quality it is equal, if not superior, to Peshanam paddy grown in the neighbourhood of Nellore and which is considered to be the best paddy in this district ;"

" the quality of the rice is equal to that of the ordinary kind, but not equal to Siroomony and other superior kinds ;"

" the grain is larger and coarser than that used by well-to-do people. The grain is however less liable to break in husking than that of ordinary paddy ;"

" the rice produced is larger, more translucent, and altogether nicer-looking than the Manawari Sumba and weighs $1\frac{1}{2}$ oz., to the measure heavier."

" The Carolina rice, though a large grain, is white, a quality which no other kind of paddy possesses ; its taste when boiled is not inferior in flavour to Sumba and Mellaghi."

33. From these extracts, and others that might be given, there can be no doubt but that, the rice, prepared from the Carolina paddy raised in this country, was really excellent, and superior to much of the rice produced in this country. The flavour of the rice, when cooked, will depend greatly upon the character of the soil upon which the paddy was raised.

London valuation of Madras-grown Carolina rice not encouraging.

34. The London valuations, of the samples of Carolina rice, from Madras-grown Carolina paddy, were certainly not encouraging, but, as was noticed in the extract given, it is very probable that the low value put upon the rice was, in consequence of its unsatisfactory appearance, due to the imperfect way in which it was prepared.

General opinions and observations regarding the crop.

35. The Deputy Collector of Arcalur reported :—

" Upon the whole I am satisfied, from the two experiments I have already made that, Carolina requires no extraordinary care in its cultivation ; like the country Car, it can be easily grown without entailing any extra expense ; and the profit, to the Ryot, I have no doubt, would be much greater than what he would obtain from the country paddy."

The Acting Sub-Collector of Salem, in submitting his report, remarked :—

" I am convinced that the Carolina paddy is far more productive than any of the indigenous kinds, and that it is so has been shown by my first experiment."

The Acting Collector of Malabar wrote :—

" The experiments were, I think, pretty successful considering the ignorance of the individuals who made them with regard to the best mode of cultivation and the best soil adapted to the growth of the plant. All soils have been tested—common rice lands, garden land, and dry paremba lands. The seed was sown broadcast and in beds, and the plants were in some instances transplanted, and in others left in the beds in which they were first sown."

The Collector of Salem wrote :—

" The peculiarities which I observed in the Carolina crop are—

" 1*st*.—That it grows and ripens much faster than the ordinary country kind.

" 2*nd*.—That the stalks are thicker and better able to stand the weight of the ear than the country paddy; it contains a larger number of grains. The country paddy stalks being very thin they bend, and the consequence is that much of the grain is lost on the ground before the crop is cut."

The Deputy Collector of Naidupet wrote :—

" The Carolina paddy has this advantage over the Peshanum (the best paddy in the Nellore District), that it is a plant of only 4 months' growth, whereas the Peshanum requires fully 6 months to come to maturity, and it (Carolina paddy) would beyond doubt fetch as good a price in the market as the Peshanum owing to the superior quality of the rice."

The Agent of the Shivagunga Zemindari wrote :—

" I do not hesitate to say that the Carolina paddy has the following advantages over the best descriptions of paddy, viz., Mellaghi and Sumba, grown in this zemindari :—(1) It reaches maturity in 4½ months and like the Mellaghi and Sumba which are ripe for the sickle only after the lapse of 6 months; (2) the outturn of Carolina paddy is much larger than that of Mellaghi and Sumba; and (3) the yield in straw is most abundant * * * * *. The grain does not drop off readily when the crop is cut or when removed from the field to the threshing ground, so that there is no such waste as there is with the other descriptions of paddy. The grain is perfectly formed; there are few if any empty shells or husks. The plant grows most vigorously, and it would appear that it does not require so much water as indigenous paddy to bring it to maturity."

The Superintendent of Government Farms in his annual report for 1871-72 wrote :—

" Paragraph 36. I report these results as showing how the one variety of paddy will grow and even thrive under circumstances that would be highly prejudicial to the other; but, from this, we are not to infer, that the former (the country) is the better variety of paddy, though, for such specially *unfavorable* circumstaces it is, undoubtedly, the best * * * * *. The fact is, unimproved varieties of plants, like unimproved breeds of animals, suffer less, when opposed by unfavorable circumstances, than do the more highly developed. Carolina paddy, is an improved variety of paddy, which has been carefully reared on the rich virgin soils of South Carolina. Our last year's experience proves, not only that remunerative crops of country paddy, can be produced on a soil that altogether fails in producing a fair crop of Carolina paddy, but also, that a soil which one year produces good crops of this grain may, in the next year, not be able to produce even half a crop. Thus soils which, in 1870, yielded as much as 40 bushels per acre of Carolina paddy, yielded last season only half as much, though, equally as well cultivated and manured, but, the explanation of this is simple; the soils which produced such good crops of Carolina paddy in 1870, were in a fresh state at the time the paddy was sown; they had not been under wet cultivation for several years; while, those sown last year with this paddy were under wet cultivation in the *previous* year, and had become reduced by the stagnation of the irrigating water in the soil, to the condition of the more inferior descriptions of paddy land, that is, to a sour, unhealthy, soapy condition, in which atmospheric agencies could have no

effect for good, in which plant food is either locked up and rendered inert, or forms combinations more or less injurious to vegetable life, but with a surface to the depth of two or three inches in more or less healthy state. It is easy to understand why, on a soil in this condition, Carolina paddy seldom does well, while country paddy may thrive. The former feeds deep down in the soil; it has long deep roots varying in length, under average circumstances, from four to six inches, while few of the rootlets are horizontal. It is very different with the roots of country paddy; nearly the whole of its rootlets radiate over the surface of the ground at right angles to the stem of the plant. They are seldom more than two or three inches in length, and are so interwoven as to form a sort of net-work well suited for supporting the plant on the semi-liquid mud in which this paddy is usually cultivated. Hence, a soil in a bad physical state, if it only has a healthy surface two or three inches in depth, may produce fair crops of country paddy, though, it will entirely fail in producing a crop of Carolina paddy. On such a soil, the Carolina paddy would start as well as the country paddy, and, would continue to grow as well *until its roots began to penetrate below the aërated soil*, when, its growth would be checked and it would gradually turn yellow and sicken. The fact is, Carolina paddy cultivation, belongs to a higher condition of agricultural practice, than has yet been reached in this country."

Less water needed by Carolina paddy.

36. The opinions of the Experimenters agreed generally, as to the smaller quantity of water needed by the Carolina plant than for the country paddy plant, and the opinion was also equally generally held that the Carolina crop suffers less, than does a crop of country paddy, when temporarily deprived of irrigation water. If, as has been shown to be the case, in several instances, the roots of the Carolina paddy plant feed deep down in the soil, while those of the country paddy plant feed in the surface soil; it is easy to understand why the former suffers less than the latter, when irrigation water is temporarily withheld. The following extracts confirm this view;—

"It (Carolina paddy) is not so much affected by a temporary failure of water as the indigenous plant."

"It requires certainly not more than one-quarter of the water necessary to produce an ordinary crop."

"Much water is injurious rather than beneficial."

"Carolina paddy is very injuriously affected by heavy rains during the first six weeks of its growth."

"I think it is very essential that the beds should be kept constantly flooded during the formation of the grain; on the other hand during the second month as little water as possible should be given."

"I am of the opinion that high lands are more suitable than low lands for the culture of Carolina paddy."

"Lighter and friable soils produced the best results."

"Where the soil was too clayey and impervious the plants did not succeed."

"Paddy land of a retentive character situated at a low level, resting on a stiff sub-soil through which there is no natural drainage or filtration, invariably becomes sour and unhealthy, after producing a crop of paddy, conditions quite opposed to the successful cultivation of Carolina paddy."

"I find that clayey lands are not well adapted for the cultivation of Carolina paddy."

"Excess of water in the land proves injurious to the crop."

Good tillage needed for Carolina paddy.

37. A number of the Experimenters agree as to the necessity for the more perfect tillage of land for Carolina paddy than for country paddy.

"Its cultivation is said to entail upon the Mirassidars more labor than country varieties; the land requires to be ploughed deeper."

"This cereal must have a deep cultivated soil."

"The want of success in the cultivation I attribute entirely to shallow ploughing."

"A very much greater crop of Carolina paddy can be obtained under high cultivation than of country paddy."

On the other hand, some Experimenters assert that the country paddy requires a much more elaborate preparation of the soil, than Carolina paddy, because, while the Carolina paddy sends its roots further in search for food the roots of the country paddy plant are always near the surface of the soil, and therefore have a more limited feeding area.

Reasons for failures in experiments.

38. Many reasons are given for the failures that have attended so many of the experiments.

"There is I fear too much reason to believe that Natives to whom the paddy was distributed were rather disposed to report unfavorably upon it, fearing that Government, on becoming aware of the heavy crops that can be raised on their land, should determine to raise their rents in proportion."

"The experiments seemed to have been unpalatable to the Mirassidars generally."

"I believe also that the cultivation did not receive proper attention from the Ryots. They do not approve of the condition to give up one-fourth of the produce yielded."

"The reasons generally given for unsuccessful results in all these cases are deficiency of rain in the early part of the season and to much rain in the latter part of the season."

"Much of the seed supplied was evidently inferior."

"Hares injured many plants, and rats and birds ate up most of the grains."

"A large portion of the plants were destroyed by cattle."

"A flood came and washed away greater part of the plants."

"Unfortunately three-fourths of the plants rotted from being inundated."

"When the plants were in ear a storm occurred and injured them."

The Deputy Collector of Naidupet remarked :

"Convinced as I am that the Carolina did not yield a crop commensurate to the care and labor bestowed on the plantation, my eyes are not shut to the fact that several of the Vadasamba fields similarly situated have shared the same fate, and the produce in some cases was even worse, although the fields sown a week or two earlier or later, and which have thus escaped the heavy rains at the earliest stage of the plantation, have thrived better."

There cannot be any doubt but that by much the largest number of experiments failed from such causes as are mentioned in the preceding extracts, causes which would have proved equally detrimental to country paddy similarly circumstanced.

39. Where country paddy is grown, care is taken that the sowings shall take place at the season of the year that is the most appropriate, when ploughing and watering can be most satisfactorily performed. But, the Carolina paddy in many experiments, was sown at unseasonable times, and under circumstances that would not have been favorable for country paddy. In some instances, this was caused by delay in receiving the seed, but in many cases there are good grounds for believing that the real reason why the Carolina paddy was exposed to unfavorable conditions by many Ryots was a desire, on their part, that the experiment should not afford, information, by the aid of which the fertility of their land could be ascertained.

Cultivators suspicious regarding object of experiments.

40. It was perhaps, but natural that the Ryots should view with suspicion, any course of action suggested by Tahsildars, or Revenue Inspectors, the officials who have so much to do with the fixing of the amount of the rent. If, the arrangement described in the following extract, was at all generally followed, in dealing with Carolina paddy Experimenters, it is not to be wondered at that the experiments were unpopular :—

"I propose that an agreement should be taken from the Ryot consenting to this experiment (Carolina paddy) in which the number of the field, area, and nature of soil might be entered and a condition added, that after the crop becomes ready for the sickle, he will cut and keep the same in the possession of a Revenue Inspector who will be deputed for that work by the Tahsildar; and that, he will render me an accurate account of the expenses incurred by him from the beginning to the end of the experiment; and that, the paddy shall be threshed and cleaned before the Revenue Inspector who would give an account to the Tahsildar."

That in many instances the Ryots did not give true returns is evident from the facts noticed in several of the reports. For instance ;—

" The Ryot to whom the seed was given for experiment reported an outturn of 22 measures but now, he admits the outturn was 250 measures. He had, it seems, concealed the facts, fearing that half of the produce would have been taken from him, as the Government share."

The Collector of South Arcot, in submitting this case to Government remarked ;—

" The information disclosed in this letter illustrates the peculiar genius of the native Ryot, and shows, how strange are still the idiosyncracies of the cultivating classes generally, in regard to their position with, and treatment, by the Government ; and, it seems almost incredible that in the present day, and with all the means of intercourse with European and educated native officials enjoyed by the people, any, but the most boorish and uncivilized, should be found to express the sentiments entertained by the Ryot Kistniah, who, to avoid being overreached as he thought, by the officers of Government, has attempted to deceive, by rendering a false account of the results of his experiment with the Carolina paddy seed given to him freely for testing its comparative value with the common paddy of the country."

41. That in many instances, the Ryots entered upon the experiments with great hesitation and suspicion is evident, from the frequent references to this state of feeling in so many of the reports, thus ;—

" I have explained to many persons during the past year that no enhancement of the assessment is contemplated on the introduction of Carolina paddy, an announcement which was received with evident relief."

" The illiterate Ryot has no faith in the production of this foreign cereal ; if he undertakes at all its cultivation, it is because he was told to do so by the Tahsildar or the Revenue Inspector. The wealthy Zemindars and Land-owners are equally indifferent to all agricultural improvement ;"

"———— is entitled to much credit for the interest taken in the experiment by him in spite of the odium he had to endure."

Climate of Madras not unsuited to Carolina paddy.

42. It was feared that, in the climate of Madras, the Carolina paddy would gradually deteriorate ; but, it appears to have great power in adapting itself to the varying conditions of the climate of this country. No deterioration in the quality of the grain does appear to have occurred to any appreciable extent, when the crop has been grown under suitable conditions. Regarding this, the Superintendent of Government Farms in a report to the Board of Revenue wrote ;—

" Carolina paddy, which has been grown in this country under suitable circumstances, is in no way inferior to the seed imported from America. One of the best crops I grew last season, 2,000 lbs. per acre, was from seed in the third generation since imported ; and, I have just issued a fine parcel of grain (the fifth generation) the produce of seed, which formed part of the yield of that crop, which was quite equal to the seed we imported from America. Deterioration does undoubtedly take place when the crop is grown under unfavorable circumstances, but it must be remembered that all our cereals deteriorate if sown, at the wrong season, on exhausted, or imperfectly-cultivated, soils. But, deterioration is less to be feared than, *the loss of purity in the sample ;* fully 50 per cent. of the samples of country-grown Carolina paddy, that have been forwarded to me, contain indigenous paddy, varying in amount *from 10 to 50 per cent.* The presence of this country paddy, amongst the Carolina grain, is altogether due to the late period in growth at which Ryots harvest their paddy ; they generally wait until the crop is *dead* ripe, when from 10 to 15 per cent. of the grain is shed by the wind, and in the harvesting of the crop, the result being, that after the removal of a crop of country paddy, the soil generally is sufficiently well seeded for another crop."

Carolina paddy seed largely mixed with country grain.

And on the same subject the Deputy Collector of Naidupett remarked :—

" I should not fail to bring another fact to your notice that when the crop was in ear, it was found that there was a large mixture of Vadasamba in all the fields

It was therefore evident that the Ryot, to whom I had entrusted the seed, had not taken proper care in securing it. He says, there must have been a mixture of some seed of Vadasamba in the field sown in 1871, and that, it has multiplied itself largely in the crop of that year, and, as the seed for the experiments of 1872 was selected from that crop, the admixture, is greater in the present crop."

Carolina paddy will degenerate if not grown under suitable conditions.

43. The Carolina paddy will certainly degenerate in this country and revert towards the type of the species from which it originated if, it is grown under less favorable conditions of soil manure or tillage than in America.

Pure Carolina paddy seed cannot now be got in Madras.

44. Though a very large quantity of Carolina paddy has been raised in this Presidency, there are grounds for believing that, at present no pure seed can be obtained in it in any quantity. Recently, every Collector was asked to furnish a supply from his District and, by none of the Districts could any pure seed be supplied. This may have been due to the Ryots not caring to part with the seed but, such an explanation is improbable, seeing that, liberal prices, would have been paid for it.

If hybridization has occurred the country paddy will have been improved.

45. It was supposed that the Carolina paddy would hybridize with indigenous varieties of paddy, but, in this Presidency there is no direct evidence that this has occurred; though, when Carolina paddy is growing side by side with country paddy and, both are in flower at the same time, it is not at all improbable but that they may hybridize. But, if the general disappearance of *pure* Carolina paddy seed in this Presidency is, in any way to be attributed to hybridization, the result, though not what was anticipated, or, hoped for, will not be altogether without benefit. Though, the absence of pure seed is unsatisfactory, as regards the introduction of the Carolina paddy crop into this country, in view to the production here, of a rice for export equal in quality to that exported from America, there can be no doubt but that, the introduction of such a large quantity of good seed has been attended with benefit to our agriculture.

46. The introduction of a new agricultural crop, is attended with difficulties in all countries; in India, those to be encountered, are perhaps greater than in any other country. However, had the same interest been taken in all the experiments, that is so noticeable in the reports of several, the general results would have been very different, to those obtained.

47. In dealing with a class of people, so ignorant and suspicious as is the cultivating class in this Presidency, it is not good policy, to entrust the introduction of new crops to officers whose duty it is to collect the land revenue. As long as the annual rent is practically unfixed, and depends in amount greatly upon the views held by these officers, so long will the Ryots view with suspicion any course of action they suggest. Further, seeing that, the rent is assessed by the Settlement Department on the results of field experiments, differing but slightly in character to the Carolina paddy experiments, it was not to be expected that the Cultivators would discern the difference; and hence, they would not attempt to remove, or ameliorate any drawbacks which the experimental crops might encounter.

Agricultural experiments troublesome and costly.

48. But, there is still another reason, to which the non-success of many of the experiments may be attributed, viz., *the trouble and expense that attends the carrying out of a field experiment.* To this subject, the following extract from a report by the Superintendent, Government Farms, refers;—

"Heretofore far too much has been expected from this annual expenditure of about one thousand Rupees on the distribution of seed. Ten or a dozen experiments are expected from each of the nineteen Collectorates. Agricultural experiments are costly and troublesome. Those unacquainted with the actual details of Farm Management, have not the least idea, how work is delayed (often during a very wet harvest when every moment is so important) by the necessity of carefully reaping, carting, weighing; housing, drying, weighing; threshing, weighing, &c., the produce of one or more

experimental plots, it often has been a cause of wonder to me, that the Ryot should put himself to so much inconvenience and loss, in conducting our experiments, seeing that, in so very few instances does he really understand the object of the experiments; and, it is not in the least surprising, that in the majority of cases, he secures his regular crops first, and leaves the experimental crops to their fate. I would very strongly advise, that, not only should the distribution of good seed be continued, but that, the practice should be very greatly extended; but, instead of issuing the seed, as at present, to a certain number of Ryots in each Collectorate would invite volunteers to come forward to make the experiments; it may, I think, be accepted as a fact, that if we cannot get volunteer agents to make our experiments, that those made by unwilling agents will possess but little value. With a view of repaying the Ryot, for his trouble and expense and stimulating his energy, I would suggest that small prizes, varying in amount from 20 to 50 Rupees should be offered for the best crop and best report (simple details of culture and observations) of any particular crop it is desirable to introduce into a new locality. Our great English Societies find it necessary, to offer medals and pieces of plate varying in value from 20 to 50 Guineas, to effect the same object; and if, this is necessary in England, in the present day, it must be much more so in this country with its backward civilization and wretched agriculture."

49. The suggestions, made in the preceding extract, met with the general approval of the Board of Revenue and, the Superintendent of Government Farms was directed to submit the outline of a scheme for giving effect to some of his proposals. From the scheme submitted the following extracts are taken;—

"2. Probably the most convenient arrangement would be to limit competition for these special prizes to certain tracts of country, and to select a fresh tract annually. The groups of districts adopted by the Board seem well suited to form the areas of competition. The group denominated East Centre, which includes Madras, Chingleput, North Arcot, and South Arcot, should, I think, be the first selected. The Madras District contains but a small area of agricultural land; still, as much of its wet land is generally well situated as regards position and manure, for Carolina paddy cultivation, it seems desirable that the same inducements should be offered in it as in the other Districts.

"3. The prizes, to be offered for competition in this group, might be as follows:—

					RS.
Four first-class	prizes, 50	Rupees each	..	..	200
Eight second-class	„ 25	„ „	..	..	200
Sixteen third-class	„ 12½	„ „	..	..	200
Thirty-two fourth-class	„ 6¼	„ „	..	..	200
Four Tahsildars'	„ 50	„ „	..	..	200
			Total	..	1,000

"4. Each District in the group will thus have allotted to it: one Tahsildar's prize, one first-class prize, two second-class prizes, four third-class prizes, eight fourth-class prizes. The Tahsildar's prize should be awarded to the Tahsildar in whose Taluq the largest area of Carolina paddy is grown during the year. The other prizes should be awarded to the growers for quality of produce.

"5. A better way would be to give the prizes for the *best crops*, but this could not be done: the Collectorates are far too extensive, and the means of transit too imperfect, to allow of isolated plots of Carolina paddy in distant parts of the Districts being inspected; but, as matters improve, smaller areas of country, even Taluqs, may be selected, and prizes offered for the *best crops* within these areas. We should, I think, first deal with groups of Districts, next with Districts, and finally with Taluqs. I should certainly prefer to reverse this order of arrangement, but the demands for immediate action in *all* parts of the Presidency are too pressing to wait the action of the *slower*, though certainly more certain way of producing the desired result.

"6. My proposal is, therefore, that, during the period ending on the last day of April 1874, competition in the cultivation of Carolina paddy should be invited in the

section of country known as the East Centre, and that the inducements to be offered should be the prizes detailed in paragraph 3 of this letter, to be awarded under the following conditions:—

(1.) That each entry consist of, at the least, 200 lbs. of the unthreshed crop in the sheaf, and 100 lbs. of the clean grain.

(2.) That the whole of the produce exhibited under each entry shall have been cultivated and produced by the exhibitor.

(3.) That the crop of which the entry is a part shall have been grown on, at the least, 1,000 square yards of land.

(4.) That each entry be accompanied by a statement showing details of cultivation and general results (to be entered in a form to be provided) with simple observations made during the growth of the crop, the accuracy and value of which will receive due weight in awarding the prizes.

"7. Every facility should be offered for obtaining seed, which should be supplied to applicants free of all cost; and suggestions for cultivation should be freely distributed, though it should be thoroughly understood that it will be more satisfactory in every way if each competitor will do exactly as he thinks best in cultivating the crop.

"8. If these proposals are allowed to form a part of the general scheme for agricultural shows, the other details might be disposed of in Committee.

"9. I would add that it would be well, I think, if for a year or two, or until a demand is created, Government would purchase for export all the Carolina paddy of good quality produced in this part of the Presidency. I believe that the growers would be satisfied with a price slightly over the price obtained for ordinary country paddy; and, with the means at disposal here, the arrangement could, I think, be worked at very little expense to Government. At present there is no local demand for this paddy, and the samples are so irregular and of such a small bulk that no merchant considers it worth collecting for export.

"10. Carolina paddy will certainly never entirely displace the ordinary native varieties of paddy, though, in some situations and under some circumstances, it may make its way amongst cultivators, if only a market for it existed.

"11. I offer these suggestions, as something in this direction might be done in connection with other means to be tried to introduce this variety of paddy into general cultivation. If Carolina paddy is ever to become a staple production of this country, it must be introduced by other means than simply broadcasting good seed over the country. There is too much of doubt and uncertainty connected with experimental crops for incomes so precarious as those enjoyed by our Ryots."

Regarding the foregoing the Board of Revenue observed:—

"Mr. Robertson suggests in the letter before the Board a modification of the system now found so successful by the Royal Agricultural Society and others which seek the improvement of agriculture by offering prizes and holding competitive exhibitions, viz., that of confining their attention periodically to a limited and well-defined and similar area at a time, and changing those areas in such a manner that the whole country comes consecutively under the operation and attention of the Society.

"2. Mr. Robertson proposes to take up the East Centre District, and confine attention to Carolina paddy. The Board consider the proposals sound and worthy of adoption; the prizes are well classified and conditioned, and they would accept them for a year's trial.

"3. But Mr. Robertson has hit the real difficulty in extending the cultivation of this improved grain. There is no local taste or demand for this new specie of rice, and it is not grown in sufficient quantity to find a place in the market."

Government approved generally of the proposals, but objected to supply the seed gratis, to purchase the paddy produced, or to give prizes to Tahsildars, and, directed that, Mr. Robertson's proposals should receive a trial for one year. Accordingly the following Notification was published:—

"NOTIFICATION.

"With a view to encourage careful husbandry, the Board of Revenue have obtained the sanction of Government to the grant of prizes in four Districts during the current year.

"The Districts will be Chingleput, Madras, North and South Arcot.

"The prizes will be given for the best crop of Carolina paddy, and will consist of one prize of 50 Rupees, two prizes of 25 Rupees each, four prizes of Rupees 12-8-0, and eight prizes of Rupees 6-4-0 in each of the above four Districts.

"The following are the conditions of the competition :—

"1. That each entry consist of, at the least, 200 lbs. of the unthreshed crop in the sheaf, and 100 lbs. of the clean grain.

"2. That the whole of the produce exhibited under each entry shall have been cultivated and produced by the exhibitor.

"3. That the crop of which the entry is a part shall have been grown on, at the least, 1,000 square yards of land.

"4. That each entry be accompanied by a statement showing details of cultivation and general results (to be entered in a form to be provided) with simple observations made during the growth of the crop, the accuracy and value of which will receive due weight in awarding the prizes.

"Ryots and others desiring to compete may obtain seed on payment of the cost, which will be the market-price of good country paddy, through the Collector of their District, from the Superintendent, Government Farms. They should apply as soon as possible to the Collector stating the quantity of seed they require and requesting that they may be supplied with a copy of the form annexed."

With this Notification the following Memorandum was published :—

"*Hints on the Cultivation of Carolina Paddy.*

"*Soil, etc.*—Carolina paddy has a very strong aversion to stagnant water; therefore avoid all land on which, from imperfect drainage, water is likely to collect and stagnate. Remember that water may stagnate in the soil as well as on its surface. Select good healthy paddy-land resting on a moderately porous sub-soil and with a surface sufficiently high that it will not become a swamp during the rains while it is yet sufficiently low to admit of being watered at a moderate cost. In the endeavour to avoid a soil that is too retentive take care that you do not select one that parts too readily with its moisture, as a soil with this defect is as objectionable as one that is too retentive. Endeavour to select a soil that is neither too retentive nor too porous; in every taluq there are hundreds of acres of wet land that fulfil these conditions. These observations refer chiefly to the physical or mechanical condition of the soil. It is of much greater importance to secure a soil in a good physical condition than one in a high manural condition, as by the application of a suitable quality and quantity of manure the last-mentioned condition can so readily be secured. Land which is being put under irrigation for the first time will nearly always produce good crops of Carolina paddy.

"*Preparation of the Soil.*—The soil may be ploughed and worked in the dry state for sowing, or it may be ploughed under water and puddled for sowing. I much prefer the former arrangement; the latter is sometimes attended with advantages, but the evils which result from the wretched state in which the soil is left by the process are frequently of a very serious kind. But, whatever plan you adopt, take care to give the soil a liberal application of good manure during the time it is being prepared for the reception of seed.

"*Seed and Sowing.*—Choose a fresh sample of seed; it should be of a rich golden color; the sample should be uniform both as regards color and the size of the grain; if the seed is mixed with the seed of country paddy (which is the case almost invariably with all country-grown samples), and you cannot get a pure sample, you may, by

using a fan and a bamboo sieve, remove the greater portion of the indigenous grain. Before you finally select the seed you should test its vitality. You may do so in the following way :—

"Take a shallow vessel—a soup-plate will answer admirably; place about one inch deep of good garden soil in the plate, and scatter over the soil 100 paddy seeds ; cover this with a piece of muslin, and over the muslin place about half an inch of soil. Keep the soil damp. After a few days the muslin with the upper soil may be lifted off and the condition of the seed ascertained. The number of seeds that have germinated will give the percentage of vital seeds. But you had better make duplicate experiments and take the average of the results obtained as the percentage of vital grain; ascertained in this way the results of the test are more trustworthy.

"Having selected suitable seed, and having prepared your land for its reception, you may proceed with the sowing. You may sow the seed at once on the land, or you may sow it in seed-beds and afterwards transplant the seedlings into the field. If you adopt the former of these arrangements, you may sow say, at the rate of fifteen measures per acre on either dry or puddled soil; if on dry soil, you may take the seed in its natural state and broadcast, or drill it in the soil; but, if you prefer to sow on a puddled surface, you may sprout the seed before you sow it. When transplanting is preferred, take care that the nursery-bed is *deeply* dug and thoroughly manured. When this is done the roots of the seedlings are small and compact, and the plants can be raised with ease and without suffering any injury in the operation. To produce seedlings for transplanting, sow eight measures, or about 18 lbs. of seed in the nursery-beds, for each acre of land to be planted ; less will probably suffice, but this quantity will provide against any loss of plant. The seedlings may be lifted for transplanting when three or four weeks old : they may be planted in the field in the puddled, or wet soil, at distances of from six to nine inches apart, a couple of seedlings being planted together. It may be good practice either to sow the seed at once in the field, or to sow it first in the nursery, and afterwards to plant out the seedlings in the field. Thus, when the area to be sown is large, the season late, labor scarce, and seed plentiful and cheap, we would adopt the former plan, and the latter, when seed is scarce and dear, the area to be cropped small, the weather favorable, and labor plentiful.

* "*Irrigating.*—In whatever way the land is sown or planted, it should be moderately watered on the same day ; this fixes the roots of the seedlings and enables the seed to meet with a good bed. It is seldom necessary to flood the land, especially after the plants begin to shade the soil. The endeavour should be to keep the land constantly damp, and not alternately in a state of puddle and dry and filled with large cracks, as is too commonly the case with wet land under ordinary paddy.

† "*After-cultivations.*—These are of a very simple nature; it is only necessary to keep the crop free of weeds and to thin out a few of the plants if the crop grows too luxuriantly.

"(Signed) W. R. ROBERTSON, M.R.A.C.,
5th September 1873. *Superintendent of Government Farms.*

"*N.B.*—The foregoing are intended only to be suggestive. Each cultivator may adopt whatever plan of cultivation he prefers."

Seed was not available for use of intending Competitors.

50. Unfortunately, the seed required to enable intending Competitors in the area of country in question, to undertake experiments, was not available; hence only a few experiments were made. It is much to be desired that the scheme should have another trial, for a year, or more, when a sufficient amount of seed is available.

General Conclusions.

51. On the whole, a fair amount of success has attended these experiments. The failures are, in many instances, to be attributed to ordinary causes under control in average seasons, and to mismanagement, or, wilful neglect.

* The practice suggested here is based on experience obtained in the neighbourhood of Madras where the evaporation is great. In districts where the evaporation is less, and where the soil is moderately retentive, the American irrigation practice might be substituted.

† Hoeing is very beneficial and should be performed.

52. There can be no doubt but that, the seed was too widely and too indiscriminately distributed. Too much was attempted; it would have been much better in every way, to have had half a dozen well-managed experiments in each District, instead of, a score or more managed as too many were.

53. Excepting, in the records of the latter experiments, the minute history of the crops has been but seldom noticed, and of such experiments it is of course impossible to form any definite opinion, as to the causes of the successes, or, failures.

54. Too little importance has been attached to the labor, trouble, and inconvenience that attends the carrying out of a field experiment. Until this, is fully recognized and, something is done to compensate the Cultivator who, undertakes such experiments, there is but little hope that they will become popular amongst our cultivating classes.

55. When our experiments are undertaken unwillingly, it is highly improbable that any satisfactory result will be obtained; it is always so easy to cause the failure of a crop and, the failure, at once puts an end to all trouble in the matter.

56. It should be borne in mind that these experimental plots, were frequently sown out of the usual sowing season, and that, therefore, if the crops did mature, they would be ready for the sickle when but few other crops were ripe, and would therefore constitute the feeding grounds of birds, squirrels, rats, insects, &c., which, in the ordinary harvest season, would have a greatly more extended feeding area, and therefore, would be less severe in their depredations on individual crops.

57. It has been proved, that the Carolina paddy reaches maturity as early as any other species of paddy grown in this Presidency; and that, the quality of its grain is, at the least, as good as that of any other variety grown.

58. Taking the whole of the results obtained, there was an amount of discordancy impossible to reduce to anything like harmony yet, by weeding out freely all those which are admittedly failures, from floods, trespassing cattle, depredation of hares, insects, &c., or by a deficiency in the water-supply, &c., results, which are clearly inaccurately recorded, and, these of experiments conducted on too insignificant a scale, we secure something like harmony; at any rate such harmony as only could be reasonably expected in experiments conducted under such varying circumstances and over such a vast area of country. This evidence, shows, decisively, that the Carolina paddy is well suited for cultivation in this Presidency; but that, it needs better treatment at the hands of the Cultivator than that to which country paddy is usually subjected.

59. The yield obtained was, in many cases, very satisfactory, but the number-of-fold standard, adopted so frequently in the reports, is no test at all, of the producing powers of the plant, when raised under different condition but, is rather a test of the physical and chemical condition of the soil, upon which the plants were grown. The fallacy of judging of the qualities of the Carolina paddy plant, from the relation the yield bore to the seed sown, is recognized, at once, when the fact is known that, in one field, from the same seed, a return of 30-fold, and of 120-fold were obtained.

60. The Carolina paddy plant, apparently, has the power of adapting itself to very varying circumstances. Though, there is a wide difference between the climate of this Presidency and, that of South Carolina, the difference between the climates* of the *cropping seasons* of the two countries is not considerable. The period of growth and maturation of a crop depends greatly upon the total amount of heat it receives, and, this total amount, does not differ greatly, within a certain range of climate, for where the temperature is lower, the crop takes a few days longer in reaching maturity than where a higher temperature prevails, other conditions being equal. Thus, the amount of heat needed to mature a crop of paddy is, approximately the same, whether the mean temperature of the District in which it is grown is 70 degrees, or 80 degrees. The number of days, the crop is in reaching maturity multiplied, by the mean temperature, of each month, will give the heat required by the crop, as shown below:—

* Of course, we need to know more than the mere average temperature of a locality in order to determine whether the climate of that locality is fitted for certain crops.

SOUTH CAROLINA.

Average date of sowing—15th of April.
Do. of reaping—15th of September.

—			Average Mean Temperature of the Month.	Total.
April,	15 days	..	57·0	855·0
May,	31 do.	..	69·8	2163·8
June,	30 do.	..	74·1	2223·0
July,	31 do.	..	79·4	2461·4
August,	31 do.	..	76·2	2362·2
September,	15 do.	..	73·1	1096·5
				11,161·9

KISTNA DISTRICT.

Average date of sowing—1st of August.
Do. of reaping—15th of December.

—			Average Mean Temperature of the Month.	Total.
August,	31 days	..	83·4	2,585·4
September,	30 do.	..	82·2	2,466·0
October,	31 do.	..	80·4	2,492 4
November,	30 do.	..	77·3	2,319 0
December,	15 do.	..	74·7	1,120·5
			..	10,983·3

MADURA DISTRICT.

Average date of sowing—1st of October.
Do. of reaping—15th of February.

—			Average Mean Temperature of the Month.	Total.
October,	31 days	..	80·0	2,480·0
November,	30 do.	..	78·3	2,349·0
December,	31 do.	..	76·5	2,371·5
January,	31 do.	..	76·3	2,365·3
February,	15 do.	..	78·4	1,176·0
			..	10,741·8

COIMBATORE DISTRICT.

Average date of sowing—15th of August.
Do. of reaping—31st of December.

—			Average Mean Temperature of the Month.	Total.
August,	16 days	..	76·9	1,230·4
September,	30 do.	..	77·1	2,313·0
October,	31 do.	..	76·3	2,365·3
November,	30 do.	..	75·4	2,262·0
December,	31 do.	..	73·6	2,281·6
			..	10,452·3

MADRAS DISTRICT.

Average date of sowing—16th of October.
Do. of reaping—28th of February.

—	Average Mean Temperature of the Month.	Total.
October, 15 days ..	77·8	1,167·0
November, 30 do. ..	77·7	2,331·0
December, 31 do. ..	79·8	2,473 8
January, 31 do. ..	74·9	2,321·9
February, 28 do. ..	77·0	2,156·0
	..	10,449·7

KURNOOL DISTRICT.

Average date of sowing—15th of August.
Do. of reaping—31st of December.

—	Average Mean Temperature of the Month.	Total.
August, 16 days ..	81·2	1,299·2
September, 30 do. ..	79·6	2,388·0
October, 31 do. ..	79·3	2,458·3
November, 30 do. ..	76·4	2,292·0
December, 31 do. ..	74·5	2,309·5
	..	10,747·0

Two cultivating seasons in Madras.

The foregoing illustrations, are not so representative as could be desired. But the necessary meteorological data was not available for all the Districts. We have, in different parts of this Presidency two distinct seasons for sowing paddy ; that is, the season which is inaugurated by the advent of the South-west monsoon and, that which begins with the appearance of the North-east monsoon; the temperature of the two seasons calculated as above differs but little. There is but a slight difference between the amount of heat required to mature a crop of paddy in this Presidency and in South Carolina, thus ;—

Districts.	Amount of Heat needed to mature a Crop of Carolina Paddy.
	Degrees.
Kistna	10,983
Madura	10,741
Coimbatore	10,452
Madras	10,449
Kurnool	10,747
South Carolina ..	11,161

The dates of sowing and reaping, given in the foregoing tables, are only approximately correct for, there is considerable diversity in the dates given in the returns of each District, due possibly, to the crops being cut at different stages of maturity. However, the dates are as correct, as the information available permits.

61. It may be assumed that, in all parts of this Presidency Carolina paddy matures in 4½ months, that is, will be fit for cutting, though the straw may not be ripe, in 4½ months from the date of sowing. In America, it is clearly established, that the

crop needs five months to reach maturity, and the American Planter always cuts the crop immediately the grain is hard, a much earlier stage than at which, in this country, it is usual to harvest paddy.

62. It has been proved that plants usually need each a particular climate; a temperature, which is favorable to one, is hurtful to another and, fatal to a third; hence, there are limits to the migration of species of plants; but some plants have a greater power of adapting themselves to new conditions than others. The paddy plant appears to have the power of modifying its habits to very varying conditions; hence, its introduction and acclimatization in so many countries; the barriers, opposed to its spread, appear to be chiefly those connected with temperature; as has been shown there are good grounds for believing that, there are no such barriers to prevent the spread of the Carolina plant to all the paddy-producing areas of this Presidency.

No climatical barrier to prevent extension of Carolina paddy cultivation over the Plains of this Presidency.

63. Experience, in attempting the naturalizing of other plants, has shown that even when the climate has been favorable, the newly-introduced plants are at first never so robust and vigorous as similar plants are in the country from which the introduction was made or, as such plants become after being thoroughly established in their new home. While undergoing naturalization, plants suffer much more severely, than they afterwards do, from irregularities in culture, or, weather. When the rice crop failed in Italy, in 1829, fresh seed was obtained from Carolina but, it was many years before the new variety of paddy adapted itself to the soil and climate. There can be no doubt, but that much greater and more continued efforts, than have yet been made, are requisite to secure the naturalization of Carolina paddy in this Presidency.

64. In dealing with the Ryots, few persons appreciate the difficulties that have to be overcome, in introducing a new crop. On this subject, the following extract is well worth attention; it is from Sir Henry S. Maine's recent work, "Village Communities," at page 103;—"Of late years it (the British Government) has done its utmost to extend and improve the cultivation of one great staple, cotton, amid difficulties which seemed to be very imperfectly understood by those who suppose that in order to obtain the sowing of a new crop in a new way, from a peasant in bondage to hereditary custom, it is enough to prove to him that it is very likely to be profitable." All who have made any attempts in this country in this direction, will agree with Sir Henry Maine, that much more requires to be done to induce the Ryot to cultivate a new crop or, adopt some other system of culture, than merely to prove that profit will result therefrom.

Superstition and ignorance prevent progress.

65. If, as there is every reason to believe, the Carolina paddy originated from seed imported into America from Madagascar, it would be better in many respects to go to Madagascar for fresh seed for India rather than to America. In the Appendix will be found a letter referring to the rice of Madagascar.

66. But, even if every success was to attend the efforts to produce in this country a sample of paddy equal, in every respect, to that grown in South Carolina, there would yet remain a great deal to be done, before the rice prepared from it could successfully compete in Europe, with the Carolina rice of America. The high price of Carolina rice is due, to a considerable extent, to the very complete preparation it undergoes for the market.

Great improvement would be necessary in the preparation of rice.

(Signed) WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

NOTES ON CAROLINA PADDY IN AMERICA.

1. When engaged in drawing up the foregoing Report I had frequent occasion to inquire regarding the habits, and mode of culture, of the Carolina paddy plant, in America. In my search, for information, I found it necessary to consult many American Publications almost unknown in this country, or in England. I consulted, with much benefit, a number of the Agricultural Newspapers of the Southern States, and, the Annual Reports of the Commissioner for Agriculture who, very kindly, furnished me with a number. I have put together much of the information thus collected, in the hope, that it will be of use to future Experimenters with Carolina paddy :—

History and Peculiarities of the Crop.

2. There is much uncertainty, as to the time when paddy was first introduced into the United States and, as regards the country from which the first seed was obtained. The most reliable accounts show that the crop was first grown some time about the middle of the 17th century. It is asserted by some authorities that the first crop raised was produced from East Indian seed while, other authorities assert equally as positively that Madagascar seed produced the first crop. Seed from India and Madagascar certainly appears to have been introduced ; and, the evidence tends to show that the Madagascar seed was introduced some time after that obtained from East India. As it is highly probable that Madagascar received the paddy crop from India, the Carolina paddy of America, may, after all, be descended from Indian paddy.

When first introduced.

3. Madagascar possesses a variety of paddy which resembles in many respects Carolina paddy. It is known in Madagascar as Rojofotsy. The grain is larger than that of ordinary Carolina paddy and, the rice obtained from it is nearly as white. It is possible that this paddy, may have been the variety introduced into America from which the Carolina paddy has descended. The color of the husk, is certainly not that golden color which characterizes the Carolina paddy but, it is quite possible that the color may have become gradually darker from the conditions the plant has met with in its new home.

4. The first seed appears to have been a white-chaff variety, similar in general appearance to that usually grown in America on uplands. This white-chaff grain for many years was, apparently, the only variety of paddy grown.

White-chaff grain.

5. The gold-seeded grain, so called from its rich golden color, is now, the ordinary Carolina paddy of commerce. It was brought into notice some time before the Revolutionary War. From its superior quality its cultivation rapidly spread over all the paddy-producing regions. Its origin, is unknown, some say that it is descended from Madagascar seed which, they say, possessed qualities similar to those which distinguish this variety of paddy, but others, assert that its qualities are altogether of a superior grade to those possessed by the imported paddy, whether from India or Madagascar, and they, attribute its present excellences to *careful culture on good soils.*

Gold-seeded grain.

6. There are two well-distinguished varieties of gold-seed paddy, the long-grain, and, the variety noticed in the previous paragraph. The long-grain is a very valuable variety, but its cultivation is on a very limited scale, from superior soils and high cultivation being necessary for its successful culture. This variety is supposed to

have been established by the careful culture, during a series of years, of the seed descended from an unusually fine ear with long grain, accidentally discovered in a crop of the ordinary variety. The rice of the long grain commands a higher price than the best qualities of the ordinary rice, but there is only a limited demand for it.

7. There are now several varieties of paddy cultivated in America; most of them are aquatic in their habits. Some, from long usage, have become suited for upland or dry tillage. It is universally admitted, that all the finest varieties need *particular care* during cultivation.

Land usually cropped with Paddy, and method of preparing it for cropping.

8. The land that has usually been found best adapted for paddy, is generally situated on the banks of tidal rivers. Such land is usually alluvial. As *thorough drainage* is deemed as essential as, a command of irrigation water, for the successful culture of the paddy crop, efforts are usually made to secure a site for a plantation where the tide, in the adjacent river, has a rise and fall of not less than 3 feet, generally, from 6 to 8 feet is considered preferable. As, salt water is so pernicious to the crop, paddy culture is generally confined to land situated above the place where the salt and fresh water meet in the river. From the rise and fall of the tides the irrigation and drainage of the land are almost under perfect control.

Thorough drainage as essential as irrigation.

9. Adjacent to all the great rivers, in the Southern States, there are vast areas of marshy alluvial land, which will probably eventually be reclaimed and utilized for producing paddy, recent experience having shown, that with the aid of steam pumps and suitable engineering arrangements, such land can be reclaimed and cultivated with profit. As yet, the crop is confined chiefly to land on which the natural irrigation and drainage facilities before mentioned can be secured.

10. The production of paddy, received such a very serious check during the late war, that the Americans were compelled at one time to become large importers of rice. During the last year or two however, there has been a very large increase in the area cropped with paddy, and the production of rice is now almost as great as ever. It is worthy of note that, a large tract of country formerly under rice plantations is now lying abandoned, from the soil having become too sour to yield a healthy, crop, the result of the neglect of drainage during and immediately after the war.

Soil injured by neglect of drainage.

11. In-land swamps, that are capable of being drained, are also, when irrigation water is available, used for growing paddy, but the profits attending such cultivation are never so great, as those obtained from the cultivation of the river-side land.

12. When these river-side swamps are being reclaimed, the first step is to protect them from being flooded by the adjacent river, this is effected by raising large embankments not only along the river boundary of the land but, around the whole of it, where there is a probability of flood-water flowing. The land that is to form the plantation, is next divided by smaller embankments into fields of from 10 to 20 acres in extent, skirting each of these banks, on the inner side, are open drains, of about 4 feet in depth, which communicate with the large main drain or channel, afterwards to be noticed. A flood-gate, or sluice, is provided for each of these fields, so that each can be watered, or drained, as circumstances demand. These fields, are again sub-divided by open ditches communicating with the side drains; thus, the field is cut up into beds of from 20 to 30 feet in width, each of which is made as level as possible. The main drain, or channel, is generally cut through the centre of the plantation; it is about from 4 to 5 feet in depth and from 20 to 30 feet in width. This channel, or drain, is used for introducing the irrigation water at high tide, and for draining off water at low tide being in connection with the adjacent river, sluices or flood-gates being provided at its junction with the river for the entrance, or escape, of the water. The channel is also used for navigation purposes for the large flat-bottomed harvest boats used on the plantations.

Reclamation of land for Paddy Culture.

Cultivation of the Crop.

13. In preparing paddy land for a crop, if the soil is known, or suspected, to be infested with an inferior kind of paddy known to the planters as volunteer paddy, it is usual first to plough to a moderate depth and to water lightly, at intervals during one or two months. This is done to cause the seed, that may be in the soil, to germinate and produce plants, the plants being afterwards killed by being ploughed down. This volunteer paddy is a most troublesome pest on the paddy plantations in America. When growing, it cannot be detected from the plants of the crop. It comes into ear sooner than any other variety of paddy, and as it sheds its grains immediately they begin to ripen, it is exceedingly difficult to avoid having the land seeded again.

Method of destroying Volunteer Paddy.

14. The first ploughing, in preparing the soil for the crop, is usually performed some time in December. Occasionally, a light covering of water is run over the newly-ploughed land in view to the furrow slice becoming thoroughly frozen, experience having shown that the pulverization produced by the thawing of the frozen soil, is much more perfect than that done by tillage implements. About the end of March, a harrow or a cultivator is passed over the furrow slices, or such portions of them as the frost has not fully acted on. The next operation is, usually, to raise the soil in ridges, which is done by means of large hoes; the ridges are, generally, from 12 to 15 inches apart, that is, from centre to centre. Occasionally, the land is dug over by means of hoes, instead of it being ploughed. Some planters consider digging in this way preferable to ploughing but, of late the practice has gradually fallen into disuse from the great increase in the price of labor in the Southern States.

15. Until recently, manure was very seldom used in paddy cultivation, the silt brought down by the rivers being considered a sufficient manuring; but now, it is largely applied on all the best-managed plantations. The use of manure necessitates much greater care in applying the irrigation water but, when a sufficiency of manure is used, a less quantity of water suffices. The husks, which are rich in mineral matters, the straw of paddy, the mill dust and other refuse of rice-mills, are largely used for manuring paddy land. A considerable quantity of the meal of the cotton seed, is also used for the same purpose. When manure is applied, it is usual to spread it over the land previous to the first ploughing and to plough it in. Occasionally, when the character of the manure admits of this, it is broadcasted over the ground as a top-dressing and is hoed into the soil. It has everywhere been found that manure, when selected and applied with judgment, produces a very marked improvement in the yield and in the quality of the grain.

Manure found to be necessary.

16. The seed is sown in different ways, sometimes, it is broadcasted and, at other times, it is drilled over the levelled surface of the ground, but usually it is sown in the furrows between the ridges before described. The quantity of seed sown, varies from 1 to 2 bushels, per acre. The weight of the seed varies from 44 to 45 lbs. per bushel. Sowing usually takes place in the first or second week in April. Great trouble is taken to secure a frequent change of seed, as it has been found that the grain deteriorates when produced year after year from the same seed. It does not appear to be the practice anywhere in the rice districts of the United States, to raise seedlings in nursery beds for transplanting into the field, as is the custom of treating indigenous paddy, in so many parts of the Madras Presidency.

Frequent change of seed necessary.

17. There is a great diversity in the irrigation practice of the rice planters of the Southern States. Usually, it is the practice to irrigate the land immediately after it is sown and to keep it under water for 4 or 5 days or until the grain has sprouted after which, the water is withdrawn, if not absorbed by the ground. This irrigation is technically termed the "sprout flow." During the following month, the land is left dry, or only slightly moistened, weeding being done when necessary. In the fifth week, irrigation water is again applied, and it is kept on the land, to within an inch or two of the top

Management of the irrigation water.

of the seedling plants, for a fortnight, the water being changed whenever necessary; this irrigation is called the "stretch flow," because of the tendency it has to lengthen the blades of the young seedlings. This watering is very beneficial in killing down any grass which may have appeared in the crop. At the end of the fortnight in question, the water is drained off, and the land remains dry for about from 4 to 5 weeks, at the expiration of which time the plants usually begin to throw up their ear sheaths. During this long period of "dry culture" the land is thoroughly hoed and cleaned. The third irrigation called the "harvest flow" is next applied and the land is kept under water, until a few days before the harvest commences, the water being frequently changed, in the interval.

18. Another practice is, to water the newly-sown land for 4 or 5 days and then to leave it dry until the seedlings are about 4 inches in height. After the plants have reached this stage, the irrigation water is again admitted over the ground for a period of a fortnight, after the expiration of which time the water is withdrawn and the land is left dry for 6 weeks, being frequently hoed in the interval. At the end of the 6 weeks, the plants being then about 14 weeks old, water is again admitted over the ground and as in the practices already described, it is kept on the land with frequent changes until the crop is ready for cutting. There are several other minor differences in the management of the irrigation water; the great aim is, to keep down the weeds, and to preserve the land in a healthy state; lengthened floodings, being intended to kill down the grass, quick drainage to cleanse the surface of the land; and, frequent dryings to restore the capillary action of the soil, to afford facilities for its culture and weeding.

19. The flowering season of the rice plant is usually in August. Should the weather be stormy in this month the anxieties of the rice planter are very great, for, stormy weather in the flowering season reduces the yield of the crop very seriously.

Harvesting.

20. The crop is usually ready for harvest about 5 months after the date of sowing; September is thus the usual harvest month. The crop is cut before being quite ripe; usually, when the lower grains are hard; it is cut by means of the sickle or the reaping-machine but, generally, by the former. It is usual to tie the crop in sheaves which are stooked in the field for a few days. When ready for stacking, the crop is boated to the stack-yard. Great care is taken in stacking, lest there should be too much heat in the stack and the grain become discolored; a little heat is considered rather an advantage, as it gives the grain a rich yellow appearance. Threshing is performed by ordinary threshing machines driven by steam. Some of these machines are very large and are capable of threshing as much as 1,000 bushels of grain per day.

The yield.

21. The yield, is generally from 40 to 60 bushels of grain per acre, weighing about 45 lbs. per bushel. The straw is usually from 4 to 5 feet in length and from 2 to 3 tons, per acre, and is much valued for feeding stock.

Preparation for the Market.

22. The paddy is husked in different ways, sometimes by ordinary horizontal mill-stones and by large iron-shod pestles working in wooden mortars. Usually, the paddy is subjected to both the mill and the mortar processes in undergoing conversion into rice, the outer husk being removed by the mill and the inner cuticle by the mortar. After leaving the mill, or mortar, the broken rice, husks, dust, &c., are separated from the rice which is then sized and polished under an elaborate arrangement; the market-value of the produce depends very greatly upon the skill with which the rice has been treat while undergoing these finishing processes. The following extract will afford some idea of the intricacy of the processes, by which paddy is converted into rice in America;—

"The rough rice is first ground between very heavy stones, running at a high speed, which partially removes the rough integument, or half chaff. This chaff is passed out of the building by spouts, and the grain by similar means conveyed into the mortars; where it is beat or pounded for a certain length of time by the alternate rising and falling of very heavy pestles shod with iron. These are operated by a revolving cylinder of huge dimensions, armed with powerful levers, which, passing into a long opening in the pestle, about 15 feet in length, raise it in mid air and let it fall suddenly into the great mortars below. From the mortars, elevators take the rice to the fans which separate the grain from the debris. From thence it goes through other fans that divide it into three qualities known as "whole," "middling," and "small rice." The grain is lastly passed through a polishing screen, lined with gauge wire and sheep-skins, which revolving vertically at the greatest possible velocity embellishes it with that pearly whiteness in which it appears in commerce.

"From the screen it falls immediately below into a tierce, which is kept slowly rotating, and struck on two sides with heavy hammers, all the time it is being filled, for the purpose of obtaining its greatest capacity. The tierce, as soon as full, is removed and coopered ready for market. The cost of such a mill was $1,000 per pestle —50 pestles being considered a good market mill."

23. The planter, sometimes decorticates the paddy and sends the clean rice into the market, but usually, the process is performed in large mills owned by persons exclusively engaged in the trade. The husking and finishing processes are also performed for hire, but, more frequently the mill-owner purchases the paddy. In New Orleans one cent. per pound is charged for husking and polishing rice of the first quality; for lower qualities the charge is usually about half a cent. for each pound of rice cleaned. A bushel of paddy of 45 lbs. will yield about 29 lbs. of clean rice.

Before the material for the foregoing notes was all collected, I had applied to Dr. Forbes Watson, M.A., M.D., &c., Director of the India Museum, who had procured the Carolina paddy seed used in the Madras experiments, for any information he could give, regarding the peculiarities of the culture of Carolina paddy in the Southern States of America. He was good enough to communicate with some Correspondents residing in the rice-producing regions of the Southern States, and has been able, to place at my disposal the following very valuable extracts, from a letter received in reply. The information afforded is very clear and practical, and though much the same ground is gone over as in "the Notes" just given, it seems highly desirable that "the extracts" should appear here in full, because the facts they give corroborate the information collected from other sources, and they afford information which has not hitherto been at the disposal of those engaged in naturalizing the Carolina paddy plant in this country. These "extracts," are from a letter, dated South Carolina, 28th of January 1876, and are as follows:—

"There are only two varieties of rice at present generally cultivated, namely, the Gold and the White; of these the Gold is much the most extensively used, probably in the proportion of more than 6 to 1, the white rice laboring under the disadvantage of shedding more readily when ripe and consequently in case of a wet harvest the waste is much greater than with the other. There is also a variety of white seed known as bearded rice somewhat resembling wheat, but it is not used by the Coast planters as the sample is inferior. The red rice is what is commonly called

Volunteer, from the fact that it puts in an appearance when it is not wanted, or in other words, it seeds itself from year to year. It is caused by the shedding of rice during the harvest and after being exposed to the action of the air and Winter rains it is ploughed in and germinates with the new crop, ripening a few days in advance, it drops its seed upon the ground whence it springs up again with the following crop. In each successive year it acquires a darker red color and the land eventually becomes so polluted with it that a change of culture is necessary to eradicate it. The peculiarity of the Volunteer is that it is impossible to harvest it in any quantity, for it sheds its seeds as it ripens, and when it is abundant, being the stronger plant, it chokes out the crop rice. Fields have been known where at least fifty bushels of rice have been matured to the acre, to yield the planter less than twenty on account of the shedding of the Volunteers.

"It is the great curse of the planter and is more dreaded than grass as it is not to be distinguished from the crop rice until harvest time. The hull of this rice is generally white and there is more or less of it in all seed, it being impossible to procure seed perfectly free in any quantity.

"The value of seed depends in a great measure upon the percentage of Volunteer, that having the least quantity being of course the most valuable. The size of the grain depends upon the culture of the fields. There is no upland culture of rice of any consequence. Many of the upland planters however sow a few acres of swampy or wet land in rice for home consumption, but the amount sent to market is inconsiderable and of very inferior quality. There is a tradition that the first rice seed was sent from England to a gentleman of Charleston enclosed in an envelope and was by him cultivated in his garden the seed produced being distributed among his friends, at first it was cultivated by draining ponds and marshy land but after two or three years it was found that grass took possession of the land *on account of the want of drainage* and it had to be abandoned afterwards large backwater reservoirs were formed and the low lands lying in front were ditched and drained; this improved the sample of the grain and some few of the best of these places are still in use. It was then found that the marshes lying near the mouth of large fresh water rivers, *where the rise and fall, or pitch, of the tides were sufficient for purposes of irrigation and drainage*, were best suited to the culture of rice, the lands were reclaimed by banking, and that portion lying immediately, on the river was divided into squares, or fields, varying in size from twelve to forty acres, according to the level of the ground. Creek bottoms were filled up and the high portions taken off to bring the land in each square as nearly on a level as possible, in these squares trunks were placed with shutters on both sides, to serve for either irrigation or drainage, the level of the trunk being low water mark which, was found on this river to give a *drainage of five feet* and the rise of spring tides being seven feet four inches enabled the planter to flow his lands to a depth of two feet if he desired it, each of these squares was surrounded by a bank, and a ditch five feet in depth and about the same in width was cut entirely around the square, this ditch is called a face ditch; the square was then divided into beds of fifty feet in width between which were cut what are called quarterdiars three feet deep and about eighteen inches wide, running from face ditch to face ditch, each field being surrounded by banks could be flowed independently of the other squares and the trunk enabled the planter to hold the water at any required level.

"The amount of land contiguous to the river being insufficient and the extent of tide lands limited, it was found necessary to clear the swamps further back, lying at the same level as the river lands, this was effected by cutting canals connected with the river by flood gates, which when opened on the rising tide would furnish sufficient water to irrigate the amount of land required, squares were laid out on each side of the canal in the manner described before, every square having its own trunk which enabled the planter to flow it while keeping any other parts of the plantation dry, some places run back from three to four miles through this system of canals. It was found that *the thorough drainage* and ability to flow at the option of the planter enabled him to keep down the grass, the great enemy of the growing crop and to depend with nearly absolute certainty upon the product, the water-supply being

unlimited and no loss has ever been sustained except from September gales, which do not occur sufficiently violent to cause a total loss more than once in fifty years.

" The lands themselves are inexhaustible and *the deposit from the river water with which they are irrigated possesses great fertilizing properties.* It is improbable, however, that these lands would ever have been reclaimed from the river without slave labor as the task would have been too expensive and too onerous for white labor besides the liability to malarial fevers and it is doubtful whether the freed man could ever have been induced to undertake it.

" Rice is planted from March to June the ditches having been cleared and the lands ploughed and harrowed, it is sown in trenches or drills fifteen inches apart and from two to three bushels of seed are used to the acre according to the fancy of the planter.

" After being sown and covered, the fields are flooded until the rice has sprouted, the time of which will vary with the weather from three to ten days.

" This flow which is called the sprout water, is then drawn off and the land kept dry until the seed has rooted and the plant made its appearance above ground, as soon as the rice can be seen for some distance in the trenches or rows, the second water which is called the stretch flow, is put on and held very deep for three or four days until the blade of the rice is stretched from four to six inches, it is then slacked off and held very shallow from twenty to thirty days, by which time the rice has become hardy and attained a vigorous growth, after which the squares are again dried and the hoes put in to break up the alleys between the rows and eradicate the grass; the rice now gets what is called the dry growth and is kept perfectly dry for a month or six weeks during which it is worked one, two, or three times, and all weeds and grass carefully picked out, on these workings the crop in a great measure depends, as soon as the stalk joints the lands are again flooded, and the water is held until the grain ripens, this is called the harvest flow, and is held about two months, when the water is drawn off, the rice is ready for the sickle and is cut and stacked in the fields, until it is brought to the thresher which is done by means of flats in the canals above mentioned. The quality and size of grain, depends upon the care exercised in the preparation and culture of the land, but more particularly upon *thorough drainage* which enables the plant to put out *deep roots* and to become strong and hardy during the dry growth, this necessitates great expense in cleansing all the ditches every year, and in keeping the trunks and floodgates in repair. After the late war the plantations having been abandoned, devastated by the enemy, the ditches had become filled up and consequently the land was sour, and it was several years before the planters could produce as good a sample as had been made previously, but by close cultivation the quality of the grain has improved year by year until now it is fully equal to any produced before the war."

(Signed) WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

29*th September* 1877.

CORRESPONDENCE, FINANCES, ESTABLISHMENT, &c.

Increase in the correspondence of the Department.

Correspondence, &c.—The correspondence of the Department continues to increase; as this increase is due chiefly to more frequent communications with persons engaged in the management of land, it affords grounds for satisfaction. Advice has been sought on many subjects connected with agricultural improvement, and we, have been favored with useful information by several correspondents. The following, are some of the subjects on which advice, or information, was given in the past year;—

Subjects.	District from which the applications came.
Manural uses of Animal Charcoal	Madras.
Lime as a manure on Coffee land	Mysore.
Cotton culture	Coorg.
The cultivation of Sorghum	Salem.
Fodder crops	Trichinopoly.
The choice of Implements and Tools for a Zemindary Farm	Tinnevelly.
Coffee cultivation, Soils, Climate, &c.	Bellary.
The culture of "the Planter's Friend"	Travancore.
Cholum, as a fodder-crop, and the merits of other indigenous fodder-crops.	Central Provinces.
Proposed purchase of a Threshing machine and a Reaping machine	Tanjore.
Feeding Horses on Guinea-grass fodder	Madras.
The culture and curing of Tobacco	Pondicherry.
The value of Slaughter-house refuse as manure; and, the means by which it could be converted into a portable manure.	Madras.
Cultivation of Guinea grass	Travancore.
Wheat cultivation	Chingleput.
The treatment of a stiff black soil, difficult to prepare for a crop	Cuddapah.
Cultivation of Sorghum	North Arcot.
Culture and treatment of Corakapilly hedges	North-West Provinces.
The "Double Mhote" as a water-lift for general use	Mysore.
Preparation of Gram for horses	Madras.
The preparation of Hay from Guinea grass	Trichinopoly.
The management of Milch cattle	Madras.
The utilization of the refuse bone charcoal, of Sugar Refineries	Wynaad.
Management of Paddy land	Mysore.
Saltpetre as a manure for Coffee shrubs	Wynaad.

2. As usual, a large correspondence was conducted with the Board of Revenue. In addition to letters on the ordinary business of the Department, the Board were addressed on the following subjects:—

Grass experiment in the Nellore District.—Submitting remarks on —. Board's Proceedings, No. 1324, dated 20th May 1876.

Sorghum Saccharatum and Planter's Friend.—Suggestions regarding the distribution of the seed of —. Board's Proceedings, No. 1109, dated 26th April 1876.

District Farm, Coimbatore.—Report on a site for—at Othikkalmandapum. Board's Proceedings, No. 1175, dated 4th May 1876.

District Farm, Coimbatore.—Report on a site for—near the town of Coimbatore. Board's Proceedings, No. 1178, dated 4th May 1876.

Commissariat Slaughter-yards.—Proposals for adapting for use as cattle-yards —. Board's Proceedings, No. 1402, dated 29th May 1876.

Prickly Comfrey.—Remarks on proposals to introduce —. Board's Proceedings, Miscellaneous No. 4908, dated 13th June 1876.

Tobacco Seed.—Proposals for obtaining for distribution —. Board's Proceedings, Miscellaneous No. 5724, dated the 7th of July 1876.

Decrease of the Grass-land of the Coimbatore District.—Remarks on —. Board's Proceedings, No. 3044, dated 2nd December 1876.

Wind Engine for raising Water.—Report on —. Board's Proceedings, No. 1768, dated the 11th of July 1876.

Agricultural College.—Submitting a list of text-books to be used in —. Board's Proceedings, No. 1961, dated the 2nd of August 1876.

Distribution of Agricultural Seeds.—Proposals —. Board's Proceedings, No. 2082, dated the 16th of August 1876.

Subterranean water; Proposals to utilize—in the Tinnevelly District.—Remarks on —. Board's Proceedings, No. 2112, dated the 18th of August 1876.

Zemindary Farm proposed in Tinnevelly.—Suggestions for establishment of —. Board's Proceedings, No. 2244, dated the 1st of September 1876.

Subsoil drainage experiment.—Report on —. Board's Proceedings, No. 3081, dated the 6th of December 1876.

3. FINANCES—*Balances.*—The balance in favor of the department at the beginning of the year was Rupees 2,09,344-8-6.

Receipts.

4. The receipts in the year amounted to Rupees 96,806-12-1 against Rupees 94,933-9-6 in the previous year. These receipts were obtained from the following sources:—Surplus Pound Funds Rupees 71,707-9-6, Provincial Funds Rupees 20,000, Sydapet Experimental Farm and Workshops Rupees 5,099-2-7. The income from the Surplus Pound Funds was Rupees 4,762-9-1 greater than last year; while, the income from the Sydapet Experimental Farm and Workshops was Rupees 2,889-6-6 less than last year, due partly to the large area of land put under grass for the cattle acclimatization experiment, and to the unfavorable character of the year.

Expenditure.

5. The total expenditure of the year was Rupees 49,819-11-6 against Rupees 56,722-12-9 in the previous year. The expenditure under the different headings was as follows;—

General Supervision.—The expenditure was Rupees 19,685-15-3 against Rupees 18,672-7-8 last year.

Sydapet Experimental Farm.—The expenditure was Rupees 12,517-10-6 against Rupees 13,125-8-8 in the previous year.

Implement Workshops.—The expenditure was Rupees 1,946-8-0 against Rupees 2,359-6-8 last year. The expenditure under this heading fluctuates with the demand for implements.

Educational (Apprentice Classes).—The expenditure was Rupees 1,356-4-8 against Rupees 2,354-11-9 last year; these classes having been abolished there will be no further expenditure under this heading.

Agricultural College.—The total expenditure incurred on account of this new Institution, during the few months it has been in existence, was Rupees 5,594-13-2.

Permanent Estate Improvements.—The total expenditure under this heading was Rupees 6,373-12-10, against Rupees 9,928-6-0 last year.

Other Charges.—These consist of transfers, made in the office of the Accountant-General, to adjust claims for purchases made in England through the Secretary of State, to pay the salary of an Inspecting Veterinary Surgeon and to meet claims in other departments, &c. These charges, amounted in all to Rupees 2,344-11-1 against Rupees 10,282-4-0 last year. The smaller expenditure is due to the appointment of Inspecting Veterinary Surgeon, having been vacant during the year.

6. There remained at the end of the year a balance, to the credit of the Department, amounting to Rupees 2,56,331-9-1.

7. The usual statement of income and expenditure appears in the Appendix.

8. *Establishment.*—Mr. Benson continued to have charge of the Sydapet Experimental Farm, and Mr. Schiffmayer had charge of the extensive Estate Improvements carried out during the year. Both gentlemen have afforded me much valuable aid. Mr. Schiffmayer's services will be available for carrying on a District Farm when they are so required. The Overseers, Clerks and others have, generally, afforded satisfaction in the performance of their respective duties.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms.

29th September 1877.

THE GROWTH OF FORAGE FOR LIVE STOCK WITH SOME REMARKS ON OUR FODDER PLANTS.

Introduction.

1. The discussion of the subject of this paper is weighted with many difficulties, owing to the branch of husbandry to which it refers being totally ignored in Southern India; this being the case, it is necessary to show, first the reasons for the introduction of the industry, and then what might be done in it by the Native cultivator.

Present custom of pasturing bad.

2. To preserve the life of their cattle, it is the habit of the ryot in many districts during the hot weather to drive them great distances in search of pasture; when he finds this pasture, probably on the slopes of some hills, in jungles and wastes, it is of a poor character, coarse, innutritious and indigestible; during the time that the stock are being depastured in this manner they are subjected to the ravages of beasts of prey, and the effects of exposure, and all their excretions are wasted as manure. The effects of this innutritious feeding are evident in the diminutive ill-formed cattle to be seen generally throughout the country.

Great value of Live Stock.

3. It is generally acknowledged, I believe, that the presence of an abundance of good agricultural stock in a country denotes agricultural wealth, and *vice versa*, and that, amongst this stock, live stock in the shape of cattle and sheep is the most important; even in Japan and China, which countries are commonly quoted as exceptions to the rule that live stock are highly valued agriculturally, it appears, from the reports of recent travellers, that the value set on them is great. The cultivating power there is in many respects very similar to that of this country; for the supposition that the cultivation is nearly all spade-culture, a system which is not to be found in this Presidency to more than a minimum extent, has been proved to be incorrect regarding the interior districts. The consumption of meat for human food in this country is considerable and in reality greater than is usually supposed.

Fodder raising profitable.

4. In Europe, America, Australia, and elsewhere, the growth of food for live stock is recognised as a most remunerative branch of husbandry. It has been proved by experience, that it is more economical to bring the food of an animal, which is either performing labor or being fattened, to it, than to let it wander in search of the means of existence. It is known, that the excreta of animals are a most valuable source of plant food, and that to collect them (their waste being a suicidal proceeding) it is necessary to confine stock to a limited area in order to accomplish it satisfactorily and economically. When cattle are allowed to roam at will, mixing herd with herd, the spread of contagious and infectious diseases is encouraged and facilitated as is shown by the enormous mortality so often seen amongst the live stock of Southern India from this cause. I have said that fodder raising is a remunerative branch of agriculture; the profits from it are not to be immediately counted out in rupees, but in the larger supplies of organic manures, so much required in this famine-stricken land, in the greater number, the better health, the earlier maturity, fuller development, greater power, and stronger constitutions of the live stock.

5. The old saying, that "the man, who makes two blades of grass to grow where one grew before, is a benefactor of his country," is a summary of the rationale of fodder raising. To keep two animals, or one animal equal to two of the description formerly kept, on the same area, should be the end and object of the husbandman. The economy of growing food for live stock, generally speaking, close to their homestead must be evident—not indeed for the young stock because they have no labor to perform, but especially for the draught and milch cattle of the country. If animals have their food brought to them, or can obtain it without much exertion being entailed on them, not having to exert any of their powers to carry them in search of it they are rested instead of fatigued whilst eating.

6. To improve a breed of cattle, it is an indispensable requisite that cattle, sires, dams, and offspring, should be well treated and properly fed; development depending

so much on the treatment and feeding of the animal. The necessity for the improvement of the cattle of this country is well known, and the economy of using powerful bullocks self-evident. On the roads and agriculturally, the want of good draught animals is a bar to economy of working. To the cultivator, the absence of good cattle prevents his adopting that practice essential to his well-being in this country—deep cultivation. To bring about this improvement better means of feeding cattle must be found, and they are to be found in the growth of forage crops.

Natural pasture.

7. The necessity of this branch of husbandry has been shown; to point out means easy of adoption for carrying it out must be my next endeavour. There are many ways in which forage may be raised, chief and simplest amongst them is natural pasture. Natural pasture in this country is generally very poor, the native grasses being all without exception harsh, coarse, and wiry; even the much vaunted Hurriallee (*Cynodon Dactylon*) is tough enough to remind one of hempen rope; a sward of grass is seldom, if ever, to be seen; tussocky growth is the common habit of the natural pasture, and demonstrates the want of attention which is paid to it. The improvement of pasture lands by such operations as drainage, cultivation, manuring, seeding, &c., is never practised, even if it be known. Although, in some few localities, the supplies of fodder are plentiful from natural growth, there is no general distribution of grazing grounds, and what areas, specially devoted to this purpose there are, are annually being encroached upon by the extension of the arable lands. Under these circumstances the improvement, that is causing greater productiveness of the existing lands, must, if no habit of growing fodder crops is introduced, necessarily take place, or the cattle of the country will decrease in number and size; their number at present is so small and their frame so diminutive as to suggest extinction. The growth of natural pasture without the aid of water is a matter of difficult attainment under conditions such as appertain in Southern India, although it is doubtless possible to improve the existing pastures most materially by judicious husbandry.

Improvement imperative.

8. Failing natural pasture, artificial grasses could be resorted to, but there is a great dearth of knowledge of what grasses and herbage plants could be successfully grown, and the question of the possibility of growing such has never been investigated excepting to a slight extent.

Guinea grass is a good fodder and fallow crop for a rotation.

9. One grass there is, which cultivated artificially yields good results, and it can be confidently recommended, to all who require such an one, as able to withstand the longest and most severe droughts without irrigation and spring into life with the first rain. It is the "Guinea grass," *Pannicum Jumentorium*, an exotic, but perfectly acclimatized grass, which is most easily propagated by root cuttings. Its culture is very simple, for if planted at the commencement of the rains, it soon strikes root and is then safe and out of danger for the future. If planted in rows it allows of interculture by cattle-power, by which means the land on which it grows may be easily cleaned, thus affording an excellent fallow crop; it will grow fairly on very poor lands; it cannot withstand the effects of stagnant water, but repays, although it does not require irrigation; half of the tussocks should be removed annually, and the crop should not be kept down too long, but alternated with others in rotation. No difficulty is experienced in removing it from the land so that it never appears as a weed. The fodder is produceable at the rate of Rupees 7 per ton and is of good quality.

Hurriallee grass very persistent and only useful in permanent pasture.

10. Hurriallee grass (*Cynodon Dactylon*), the Doob grass of Northern India, the Couch grass of Australia and America, is a valuable, but, I believe, overrated fodder plant, possessing great vitality and widespreading roots which are capable of propagating the grass from each section of them; it is suited to our long droughts and is also capable, under high cultivation and irrigation of producing heavy cuttings of tough wiry fodder, which however must possess considerable nutritive qualities; on poor soils it is liable to be crushed out by inferior types of plant, but on those of fair quality it is very persistent and hard to eradicate; the latter point is detrimental to its use as a crop to be taken in a rotation. The cost of producing a ton of Hurriallee grass is about Rupees 10, whilst in Madras one ton of hay which equals about three tons of green

grass may be sold for Rupees 30—40. The growth of the grass might be encouraged on waste lands by manuring and seeding, but its cultivation can scarcely be recommended except near large centres of population, where there is a demand for such forage.

Great abundance of artificial forage plants.

11. Passing from pasture, natural and artificial, I come to the next resort of the stock keeper—forage plants. If the indigenous and presently acclimatized exotic plants do not furnish an abundance of variety of pasture, it cannot be said that artificial forage crops are wanting. The ryot, who knows as little of raising special fodder crops as he does of the management of pasture, from his ignorance neglects the splendid, and unexcelled in more favored countries, sources of forage that are ready under his hand, which would enable him to produce food enough to feed far more and better stock than he has at present, and by this means to manure his lands better, thus making them capable of producing crops in seasons of drought and increasing their yield during ordinary ones.

Sugar-cane good source of fodder.

12. First, pre-eminent, stands the Sugar-cane (*saccharum officinarum*), an unrivalled producer of valuable, enticing, succulent fodder at a cheap rate. Occupying the ground about nine months only, it will produce over 100,000 lb. per acre, and not costing more than Rupees 2 per ton at the outside. Sugar-cane is an exhausting crop under the practice of growing it for external sale, but if grown as a fodder this objection to it would disappear, as the manure of the animals fed on it would contain the major portion of the valuable constituents of the soil, which it extracts during its growth. If given whole great waste would ensue with this fodder, but if chaffed the more succulent and the coarser portions becoming intimately mixed would all be consumed by stock. If the canes were used for the manufacture of sugar, the refuse, if chaffed and properly treated, could still be used for fodder.

Yellow Cholum very valuable and easily grown fodder.

13. *Sorghum vulgare*, the great millet, (Tam.) Cholum, (Tel.) Jonna, (Hind.) Jowar, stands next amongst the many plants indigenous to this country which are most economical fodder-producers. This grass is largely cultivated as a grain producer in all parts of India, the straw thus grown is used as cattle food, but the growth of it as a fodder crop, to be cut when green and succulent, is unknown to but a very small extent; cultivated well the yellow variety produces at all times of the year heavy crops of fodder; naturally, it requires irrigation, if grown during the dry season, but all the water it receives it amply repays. Producing at a single cutting often from 10,000 to 15,000 lbs. per acre, it will yield three or four cuttings and a total outturn of thirty to fifty thousand pounds at a cost of about Rupees 2 per ton. It will grow on most soils, even very poor ones, as is shown by its success on the Sydapet Farm; but, for growth to perfection at a cheap rate, stronger soils, such as those found in Bellary and Cuddapah, denominated "black cotton soils," are most suitable.

White Cholum in a great measure possesses the qualities of the yellow variety, to which it is closely allied and from which it differs chiefly in the color of the seed and the character of the panicle.

14. *Penicillaria spicata*, (Tam.) Cumboo, (Tel.) Sujjaloo, (Hind.) Bajree, is another indigenous plant, especially suited for cultivation, during a season of high temperature and light rainfall, on lands which it is not possible to irrigate. It is chiefly grown on the poorer classes of soils and does not produce very heavily. It grows well in some localities under irrigation, but does not come up to cholum either in productive powers or in the quality of the forage produced.

15. *Panicum Milliare*, (Tam.) Shamay, (Tel.) Samaloo, has been proved to produce as much as 47,000 lbs. of green fodder per acre with considerable supplies of water; the cost of production was under Rupees 2 per ton, and the fodder of fairly good quality but soft and watery. It yields two or three cuttings from one sowing.

16. *Oryza sativa.*—The country paddy may be grown profitably as a fodder crop, especially within short distances of large towns, and, in seasons of deficient rainfall, as the short supply of water, although totally inadequate for the production of a grain crop, might mature a very profitable fodder crop. Paddy will produce from fifteen to twenty thousand pounds of green fodder, or four to five thousand pounds of hay at a cost of about Rupees 2-8-0 per ton for fodder, and Rupees 7-8-0 for the hay. On the rain-fed lands, so common in Chingleput district, the growth of such a crop

would, I have no doubt, prove far more remunerative to the ryot, than the results of his endeavours to produce a crop of grain.

17. *Eleusine corocana*, (Tam.) Kelvaragoo, (Tel.) Taindulu, (Hind.) Ragi, is a fair fodder producer, but yields grain also well under moderate irrigation.

18. Horse Gram, *Dolichos uniflorus*, (Tam.) Kolloo, (Tel.) Woolavaloo, (Hind.) Koolthee, is a valuable pulse crop for forage or green manure. It produces from two to four thousand pounds of fodder in two months, at a cost of about Rupees 3 per ton and thrives with a minimum rainfall in very hot weather. The ease with which it may be cultivated recommends it most highly as a catch crop for forage purposes, either to be grazed on the land or fed in the stalls.

Deficiency of leguminous forage plants.

19. The other pulse crops of the country, are useful but not to be specially recommended for the production of fodder, and in this direction there is a want. The lack of a good leguminous plant which could be mixed with grasses in forming a pasture will be felt when that branch of husbandry is taken up; the small amount of, if any, research in the direction of improvement of pastures, &c., in this country has arisen simply from the want of good Agricultural Botanists, who would devote their time to the investigation of the comparatively uninteresting division of graminacious and other agriculturally important orders of plants. There are probably existing in other countries, grasses, legumes, and other pasture plants which might be acclimatized in this country; the study of such an extensive branch of husbandry will be a great work.

Very valuable and enticing fodder.

20. *Sorghum saccharatum.*—Of the exotic crops, which have been most successfully cultivated in this country, foremost stands the Chinese Sugar-cane, and the sub-varieties of the same plant—"Planters Friend" and "Imphee"—closely allied to our cholum, flourishing under the same conditions, it possesses several advantages over that crop; the succulence and richness in saccharine matters of the straw; the ease with which it rattoons, and the consequent possibility of raising more than one cutting from one sowing, which habit although possessed by the cholum, is more marked and perfect in this crop. The possibility of producing a crop of green fodder as well as seed is characteristic of the plant. The crop is scarcely able as yet to withstand the heats of the plains, but in the cold weather will produce from 15,000 to 20,000 pounds of straw per acre, besides 1,000 to 1,500 pounds of grain at a single cutting.

21. Maize, (*Zea mays*), (Tam.) Mukha Cholum, (Tel.) Moka Jonna, (Hind.) Mukha Jowari, is not really an exotic crop, for there are depraved varieties of it to be found growing on limited areas in various parts of the country; but, when speaking of maize, I refer more particularly to American and Australian varieties. Maize flourishes wherever cholum will grow well; requiring however a deeper soil, more organic manure and better cultivation. Grown for seed, it produces an enormous amount of nutritious grain; if cultivated for fodder, the forage produced is of very high value. In quantity it will equal the yellow cholum, but is rather more costly.

22. Lucerne (*Medicago sativa*) has been successfully grown and produces a valuable fodder, but the price of it has as yet not been determined. It can be kept on the land for a considerable length of time (three or four years) and will leave it in a better condition for growing cereals than before.

23. In conclusion, there is, I have shown, no want of suitable fodder-producing plants amongst those grown commonly by the South India cultivator, but he does not make use of the opportunities before him nor avail himself of the gifts that are given him. The importance of the industry is great, and the sooner it is introduced the more advantageous to the country. Until it is introduced we cannot hope for the development of powerful breeds of cattle wherewith it will be possible to improve economically the cultivation pursued in one of its greatest failings; and with its introduction we may hope to see, what is not seen now—a marked increase of the number of cattle supported by an acre of arable land. The power to perform deep culture, and the manure wherewith to grow good crops are both required; neither of those will be attained without larger and better supplies of fodder than at present exist.

SYDAPET, (Signed) CHARLES BENSON, M.R.A.C.
14th September 1877.

THE PERNICIOUS EFFECTS OF THE USE OF CATTLE DUNG AS FUEL.

All solid excrements burnt.

1. The use of bratties (thin cakes) made from the solid excrement of cattle is general throughout India. The consumption of this fuel is enormous and may practically be said to include the whole of the fæces of the cattle of the country, excepting a little that is dropped whilst they are being depastured at a distance. The collection is carried on unremittingly and most meritoriously, for, everywhere and always, women can be seen collecting the precious substance on the high roads and in the fields.

2. The collection of the manure dropped on the roads is the only good point which this habit of the nation brings into operation; for, if it were not collected as it is for fuel, the manure would in all probability be totally lost, the inorganic as well as the organic constituents, which are now dissipated so wantonly when it is burnt.

Organic matters lost in this Presidency.

3. There are in this Presidency about 8¼ million head of horned cattle, the solid excrements of each of these may be said to amount to about 8,000 lbs.* per annum, of this mass 85 per cent. will be water, the remainder dry organic matter and ash. The mineral constituents will amount to about 2·25 per cent., the rest being dissipated in the process of combustion. One-half at least of the excrements are dropped whilst the cattle are penned at night, when they should be in their stalls; thus the amount of dry organic matter wasted annually per head of stock is about 500 lbs., amounting to a total for the whole Presidency of 1,840,000 tons.

Physical action of organic matter.

4. This loss of organic matter affects the powers of the soil in more ways than one. For, leaving out of consideration the loss of plant food, organic matter is known and has been proved to influence the capacity of the soil to absorb and retain water to a very great degree; a most important matter for consideration in this country where droughts so often destroy or injure the crops.

Chemical action of organic matter.

5. Organic matter also opens up, and thus exposes, the soil to the influences of the atmosphere, which acting as they do, disintegrate its particles and render its constituents more soluble; it also furnishes in its decomposition organic acids, which act on the soil-constituents, and reduce them to a condition in which they are available for plant food, as well as on the nitrogen of the air and water causing the formation of ammonia in the soil, where it is immediately available for the development of plants.

6. Organic manure thus improves the physical state and texture of the soil, and also renders it a more fertile field for the roots of plants in which to search for their food.

Great loss of Ammonia.

7. The loss of plant food caused by the combustion of cattle dung, although at first sight, when the small percentage of ammonia which is the substance so lost is considered, may appear insignificant, yet, when it is remembered that annually for every head of cattle in the Presidency 12 lbs. of the life-blood of plants is thus dissipated into its primary elements, the sum total, wilfully, needlessly, wasted is enormous,—being about 44,000 tons.

8. The use of litter to absorb the urine voided by cattle whilst they are penned at night is seldom if ever thought of; and thus it is wasted and lost altogether unnecessarily, for substances suitable for litter are plentiful enough.

Composition of urine.

9. The value of urine as a source of plant food is undeniable. The amount voided will amount to at least 4,000 lbs.† per annum per head of horned stock in this Presidency. The composition of it,

---

* Boussingault found that cattle voided about 20,000 lbs. of solid excrement per annum.

† Boussingault found that a milch cow voided 10,000 lbs. per annum.

although no doubt subject to variations caused by the age, sex, condition, feeding, and treatment of the animal, as given by the best authorities, is much as follows:—

Water	91·20	per cent.
Organic matter	6·20	„
Ash	2·60	„

The organic matters are most highly nitrogenized, and contain nitrogen amounting, when calculated as ammonia (N. H_3), to nearly one-third of the total quantity, or about 1·8 per cent. of the urine. A glance at the composition of the ash is sufficient to show how valuable it is, and how egregious the error is, in allowing it to be wasted.

Composition of the ash of the

Urine of the Ox.

Carbonate of Lime	1·1	per cent.
Carbonate of Magnesia	6·9	„
Carbonate of Potash	77·3	„
Common salt	·30	„
Sulphate of Potash	13·30	„
Silica	·35	„
Oxide of Iron and loss	·75	„

The very high percentage of potash salts, about 91 per cent. of the whole, immediately shows how important the preservation of the liquid manure is. Although it may be said that the figures given above are not the results of analyses of the urine of cattle fed and treated as those of this country usually are, and this shows the want of scientific inquiry into the matter, yet it tells us that the amount of potash salts in the urine is considerable, and these are altogether lost under the native system.

Loss of plant food due to waste of urine.

10. The waste of valuable plant food, from the neglect of preserving the urine of the cattle stock of the country, is very great, for, when it is considered that each animal must void at least 2,000 lbs. of urine per annum, whilst it is neither at work, nor grazing, and when the composition of this liquid is known to be so rich in ammonia and potash as it is, the fact is apparent. The amount of ammonia lost per head annually in the urine is not less than 30 lbs., and that of potash, taking half of the ash *only* to be composed of that mineral, not less than 25 lbs.

The total loss for the Presidency is represented about as follows:—

Ammonia	110,000 tons.
Potash	92,000 tons.

11. I have shown as yet the direct losses only, which may be summed up as follows:—

Organic matter in the fæces	1,840,000 tons,
Do. do. urine	370,000 tons,

or nearly two million and a quarter tons of a substance much needed in all the arable soils of the country, and one which under the native system of culture is seldom added to intentionally; the value of it is difficult to estimate, but cannot be put at less than Rupees 3 per ton, at which rate the total loss amounts to Rupees 66,30,000 per annum. The ammonia lost, although the total loss can scarcely be put down to the habit of burning cattle dung, amounts

Summary of losses.

In the fæces to	44,000
Do. urine	110,000
Total	154,000

Estimating that one half of the quantity only is wasted owing to this habit, and valuing the substance at Rupees 500 * per ton, the annual loss would be Rupees 3,85,00,000.

* Mr. J. B. Lawes, F.R.S., in England, values Ammonia at £75 per ton.
Potash £18·15 „

The waste of potash has been shown to be 92,000 tons, and none or very little of this need be lost, if proper means of preserving it were adopted; valuing it at Rupees 150 * per ton the total waste amounts to Rupees 1,38,00,000. Collating the figures given above I find that the total loss to the country annually is much as follows:—

Annual loss to country.

	RS.
Organic matters worth	66,30,000
Ammonia	3,85,00,000
Potash	1,38,00,000
Total ..	5,89,30,000

12. Some persons have asserted that the practice, already alluded to, of collecting so much of the dung which would otherwise be lost, recompenses, the manure heap for the robbery it is subjected to, by means of the increased amount of ashes that are brought to it. Whether the ashes of the fuel of the people are ever returned to the soil to any considerable extent is a most doubtful matter, so that, leaving out of the question the loss of organic manure, and the fact that, if cattle dung were not used as fuel, wood † or some other substances leaving ashes would be, the practice is of questionable importance.

Ashes of day collections.

13. I have already estimated the solid excrements of cattle to amount per head annually to 8,000 lbs., assuming that seven-eighths of this amount is collected and made into bratties for fuel, and that four-sevenths of the collections are made at night from the excretions of the animals whilst they are penned, the following figures represent the total of wet dung collected in this Presidency;

Total collections of fæces.

From cattle at night	11,160,000 tons.
Do. during day	8,370,000 „
Total ..	19,530,000 „

Of this mass about 2·5 per cent. are mineral matters, which thus amount to 488,250 tons. The valuable portions of the ash are chiefly Lime, Magnesia, Potash, and *Phosphoric acid*, existing in the proportion of about 10, 2, 1, and 7 per cent., respectively. The amount collected of each of these constituents is therefore about;

—	At Night.	By Day.
Lime	27,900 tons.	20,900 tons.
Magnesia	5,600 „	4,200 „
Potash	2,800 „	2,100 „
Phosphoric acid	19,500 „	14,700 „

14. The ash of the day collections are, I have already said, supposed by some to repay the losses caused by using the cattle dung for fuel; valuing these ashes at the following rates;

	RS.
Lime	15 per ton.
Magnesia	12 „
Potash	150 „
Phosphoric Acid ‡	200 „

and supposing that all of the ashes are returned to the soil the account may be shown to be nearly as follows,

Loss.		*Gain.*	
Organic matter. Ammonia. Potash.	Rs. 5,89,30,000.	Ash of day collections.	Rs. 36,18,900.
		Actual losses	Rs. 5,53,11,100.

* The ashes of wood contain from 5 to 20 per cent. of Phosphoric acid besides about 10 to 15 per cent. of Potash.

† Mr. J. B. Lawes, F.R.S., values Phosphoric acid £20·10 in England.

‡ *Note.*—These are taken from some figures compiled by Dr. Forbes Watson. The accuracy of the figures or their applicability to ordinary grains cannot be vouched for. Probably the samples they refer to were selected especially for their quality. No really reliable analyses of the ordinary food-grains of the country exist.

Thus, under the most favorable circumstances, when all the ashes are carefully collected and returned to the land, the loss from this system in this Presidency alone amounts annually to nearly 5 million pounds sterling. But, considering that at a favorable estimate at least one-half of all the ashes are never rendered available for plant food, the loss is nearer

Lime	3,500 tons.
Magnesia	700 „
Potash	350 „
Phosphoric acid	2,400 „

15. Leaving out the constituents of minor value, Lime and Magnesia, the total loss per annum in the Presidency of plant food from this practice is nearly as follows—

Ammonia	77,000 tons.
Potash	92,000 „
Phosphoric acid	2,400 „

of an aggregate value of about Rupees 5,27,80,000 *besides the organic matters*, the value of which, as I have already stated, it is most difficult to estimate, although it is well known that the deficiency of it in Indian soils is a point of incalculable detriment to their productive and drought-resisting powers.

16. There is another element which adds materially to the benefits of cattle dung as a source of manure, that is, the minutely divided state in which its constituents exist, and the consequent facility for its application to the land in a manner in which it is easily made use of by plants.

17. The importance of the three constituents which I have been referring to is shown clearly in the following table, giving the amount of each required in the formation of 1,000 tons of the following grains, respectively:—

—	Ammonia.	Phosphoric acid.	Potash.
Wheat	2·86	8·2	5·5
Maize	1·9	5·5	3·3
‡ Yellow Cholum (*Sorghum vulgare*) ..	1·48	8·56	2·07
Rice	1·15	1·7	·8
‡ Cumboo (*Penicillaria spicata*) ..	1·62	6·78	4·05
‡ Raggy (*Eleusine corocana*)	1·03	5·95	5·34
Maize straw	4·74	3·8	16·6

18. The figures given above, although they are probably often varied from considerably in different samples, are yet sufficiently accurate to serve as a type, and in looking at them it must be remembered that, although an excess of one constituent in the soil may slightly alter the relative quantities of other constituents taken up by a plant, the proximate composition is always nearly the same. The figures show a great demand for Phosphoric acid, and with reference to this want, the supplies of cattle dung are totally inadequate to supply a sufficient quantity of that substance; and the necessity of rendering every possible source of it available, for instilling into the intellects of the cultivators the urgent necessity for the use of bones, wood and cattle dung ashes, and night-soil as manures, and for the investigation of the question of the existence of phosphatic guanos, like those found in South Carolina, coprolities, apatite, or any other source of Phosphoric acid in this country is most evident.

Great want of Phosphoric acid.

19. It has been asserted by some authorities that "it is difficult to see whence a sufficiency of manure is to be procured" wherewith to manure the irrigated lands, in order that the water at present used may be economized. I have shown, if this pernicious habit were put a stop to, that at least 2,210,000 tons of dry organic matters would annually be rendered available as manure, an amount which would equal at least $3\frac{1}{4}$ million tons of manure (excluding litter), or a supply of $\frac{3}{4}$ ton per acre per annum to all

Organic manure sufficient to halve water required for paddy crop.

the paddy lands of the country of what they most require. If this manure were applied regularly for 12 years I venture to assert that half the present quantity of water used would suffice to raise heavier crops of paddy. Trees would have to be very extensively planted, if the use of cattle dung fuel were stopped and thus the supplies of leaf manure would be vastly and annually increased.

20. I have confined myself as yet to pointing out the pernicious effects of the habit, how it may be avoided should also be shown, as well as how it might be put a stop to. Cattle dung is apparently used as fuel for two reasons, firstly, because it is often seemingly cheaper to the consumer and perhaps more convenient; secondly, from habit, instilled into the ways of the people for many generations. The reason why it is cheaper than fire-wood is the want of that article, which want could be easily avoided by planting much of the inferior soils which now produce, if anything, only a very scanty and low class of pasturage, but which could easily be brought to grow trees; by this means the soils would be improved, the decaying leaves increasing the organic matter in them; and also as the roots of trees seek deeper down for their supplies of nourishment they would render a greater field available from which to draw plant food for the growth of our field crops. The practice pursued in Japan of causing three trees to be planted for every one felled is worth mention here.

Growth of trees improves soils.

21. The use of cattle dung fuel by any one for any purpose can be rendered unnecessary, and how to render it unnecessary is, in my opinion, a most important question; it can be rendered a luxury by adequate planting of fuel trees. To bring about this much-to-be-desired reform, something, more than the present encouragements held out to persons who plant trees, should be done; if it be impolitic to enforce the planting of portions of every village with fuel trees, which is doubtful, it cannot be to place a tax, on the cattle dung used as fuel, to be annually increased in amount as the chances of having supplies of fuel from other sources have been added to, time being allowed for the growth of trees. Toddy and arrack are taxed, why should not a habit, even more detrimental to the well-being of the country than the consumption of spirits, and which can be rendered greater luxury? The profits of such a tax would in a measure repay the interest of the outlay on the famines which are so much intensified by this habit. The price of fire-wood in Sydapet is about Rupees 7, and that of bratties about Rupees 17½ per ton; the reason for the use of bratties is explained by the fact that, the dung being collected by the females of the family, no disbursement is required to obtain a supply. Supposing that a tax of Rupees 2 per ton were imposed on their manufacture, an income, if the present rate of consumption continued, would accrue of over 90 lakhs of Rupees, an amount equal to the total excise and customs duties of this Presidency. Good fire-wood, equal in quality to that of the Casuarina, should be obtainable in ten years in all parts of the country at Rupees 5 per ton, which amount might be fixed as the ultimate rate for the bratty tax.

Cattle dung fuel should be rendered a luxury.

SYDAPET, (Signed) CHARLES BENSON, M.R.A.C.
30*th August* 1877.

THE PHYSICAL PROPERTIES OF THE SOIL AS INFLUENCED BY TILLAGE AND THE APPLICATION OF ORGANIC MANURE.

1. The soil must be regarded in a two-fold aspect, first with reference to its chemical composition, and secondly in respect to its physical properties. Few plants of any value, except the arboreous kinds, attain any degree of perfection in an uncultivated soil, since the soil in its natural state seldom possesses the chemical composition and physical properties, necessary for the production of cultivated crops.

2. In most instances, one or more of the elements essential to the vigorous growth of plants, are not to be found, or, if present, are either deficient in quantity, or exist in combinations, in which they cannot be absorbed, or that are injurious to the growth of plants; or, again, the physical condition of the soil is such as to render these elements altogether ineffective. The chief object that occupies the attention of the Agriculturist is the removal, or the diminution, of these defects of the soil, and this is effected by mechanical operations, by tillage, the application of manure, &c.

3. Whether the adoption of one or other of these means should receive the greatest amount of attention depends firstly, and chiefly, on the state of the soil; then, on the speciality of the crop to be raised, as well as on the possibility of realizing a return, equal to the sum spent on labor, &c., in the production of the crop; the ability of the cultivator, and other circumstances often most difficult to determine. Generally, the application of manure tends to supply one or more of the elements that constitute the food of the plant which may be deficient in quantity. Tillage tends to render the existing food, in inert chemical combinations, available for the plants as well as removes the injurious tendency of other chemical ingredients, it improves also the physical qualities of the soil, exterminates weeds, &c. But, manures are often applied for the purpose of improving the physical properties of the soil and as solvents for the inert chemical combinations. The first process, is nearly always accompanied with good effect, but the latter, if carried to excess, is apt to impair the fertility of the soil and may in the course of time render it unprofitable for future cultivation. There may be many cases where, even under high cultivation, an addition of manure would not increase the production of the crop, the soil being naturally so rich that without manure the highest possible produce is obtainable, but very rarely will it occur that without mechanical operations and proper tillage, a produce at all satisfactory will be obtained. A soil, judged by its chemical composition, may be deemed very fertile, yet in reality be unfit to produce anything, until its physical qualities are improved by proper tillage.

4. The conditions of fertility are very varied; the presence in the soil of the food of plants is important but, the physical properties of the soil frequently possesses a greater importance. To this, must chiefly be attributed the failures that resulted from too hasty conclusions, drawn from chemical analyses of soils, by certain enthusiastic admirers of chemistry, who believed, that the presence in the soil of those elements that constitute the plant food was sufficient to determine the question of its fertility. For the purpose of obtaining the highest possible produce, the soil is broken up by various tools and instruments, pulverized and made mellow, &c., so as to suit each special want.

5. The more the science of agriculture is advanced in a country, the more is recognized the importance of thorough tillage, which in such places has been extended even to forest land, especially since the value of forest conservation has come to be thoroughly understood and appreciated.

6. The most important result obtained by tilling the ground is, the improvement of the physical properties of the soil, because the chemical actions will only then have full play when the atmospheric air can freely circulate in the soil. The soil, considered generally, is an accumulation of fine molecules invisible to the eye, and

* In the last Annual Report (1875-76) will be found some valuable results obtained by Mr. Schiffmayer that afford much information regarding the physical properties of soils.

representing a fine powder or dust. This accumulation of fine particles, being the product of the complete disintegration of rocks, represents the essential part of the soil, and is mixed with grains of sand more or less large intermingled with fragments of rock. This pulverized mass with the less decomposed fragments of rocks constitutes the geognostic base of the soil, and from the occurrence of organic matter in the top-layer, we distinguish generally between surface and subsoil. The pulverized mass and the finely-distributed organic matter determine chiefly the physical properties of the soil.

7. If grains of soil, more or less round, lie together, they come in contact only in a few points, of their surface, between them are spaces or interstices. Even melted metal possesses these interstices between its molecules. In the soil, these interstices are of the utmost importance, because, if the circulation of air is not prevented, they are filled with air and determine the porosity of the soil. Every solid substance attracts gases and condenses them under certain conditions.

8. As attraction, is a function of the material's surface, it is evident that the effect of the attraction, depends on the area of the surface. The more pulverized a soil is, and the more pores it contains, the greater surface does its particles exhibit and, consequently the more gases can such a soil absorb. For this reason sand absorbs much less gas than clay, and a well-tilled and pulverized soil more than a soil roughly ploughed. Consequently a soil deeply tilled absorbs more than one that is shallow tilled. It has been ascertained that the lower the temperature of the soil, the greater is the absorption that takes place, and to this circumstance chiefly is attributed the beneficial effects that a low temperature produces on the soil, a fact with which every practical farmer in Europe is familiar. With regard to absorption of atmospheric air, it may be mentioned that oxygen and nitrogen are both absorbed by the soil, to a limited extent.

9. Although the attraction of oxygen is not intense, the readiness with which this gas enters into combination is the cause of a great amount of oxygen being absorbed. The particles of soil condense the oxygen on their surface and this entering into chemical combination with them oxydation takes place. By oxydation the free oxygen is removed and the particles of the soil are thereby enabled continually to absorb fresh oxygen. When the surface of the particles of soil is not oxydable, the absorption is only trifling. Most soils, however, are made up of constituents favoring the absorption of oxygen, especially such as contain inferior oxydes of iron and humus.

10. Protoxyd and other inferior combinations of iron are highly qualified to absorb oxygen, provided the circulation of atmospheric air is favored by frequent and deep tillage.

11. A soil possessing a large amount of iron as protoxyd in the subsoil, may, when this is brought suddenly to the surface, exhibit for a certain time indications of barrenness, but this is not on account of any obnoxious or poisonous quality of the combinations of iron, but must, chiefly, be attributed to the fact that all the oxygen of the air circulating in the soil is absorbed by the protoxyd to form higher combinations of iron, so that little or none is left available for the roots of the plants. It has been clearly shown that the roots of plants always keep up respiration. The plant is enabled to grow more rapidly and yield much more when there is an unlimited supply of free oxygen in the soil. An experiment made by Stockhardt demonstrates how much the yield of a crop depends on a liberal supply of atmospheric air. He filled two cylindrical glasses measuring 2·5 feet in height and 5·5 inches in diameter each, with soil. In each cylinder was sown five grains of oats and three of peas. One of the cylinders was perforated at the bottom which was brought in connection with a gasometer filled with atmospheric air. The vegetation period extended from 14th of June until the 3rd of October during which time the soil in the perforated cylinder received daily 1,000 cubic centimeter of atmospheric air from the gasometer, whilst the soil in the other cylinder could receive atmospheric air only from its surface. Besides this, both cylinders remained under equal conditions; the soil was a loamy sand containing much humus. The outturn on dry plant substance was as follows ;—

Without additional supply of atmospheric air.	Grammes	*With additional supply of atmospheric air.*	Grammes.
Five plants of oats	3·90	Five plants of oats	7·65
Three do. of peas	1·72	Three do. of peas	2·46
Roots of both	0·27	Roots of both	0·38
Total ..	5·89	Total ..	10·49

The soil receiving a liberal supply of atmospheric air produced twice as much as the other. The circulation of atmospheric air in the soil promotes in a special manner the development of the roots. Schuhmacher found that barley plants, which he grew in a pot provided with a tube to conduct atmospheric air to their roots, had produced roots three times as heavy as other plants grown under the same conditions but not provided with a tube.

12. The need of oxygen for respiration varies very much in the different species of plants, but, as a rule, the more valuable species require more than the lower kinds. From this it is evident that it is impossible for the higher types of plants to thrive as long as they have but a limited supply of the element most essential to their growth. A soil containing much protoxyd of iron is therefore the most in need of frequent and deep tillage, in order that oxydation should take place in the shortest time to enable the roots to penetrate to a greater depth in order to come in contact with a greater amount of vegetable food and to meet the other conditions necessary for the healthy growth of the plant. In most cases with such a soil, especially in climates with little change of temperature, deep tillage should be gradually effected. To fallow the land for a certain period, frequently ploughing and stirring up the soil in the meantime, greatly promotes its disintegration. It has been ascertained that oxygen is but slightly absorbed by sand, gypsum, and calcareous earth, but largely by clay, and in the highest degree by humus. An experiment made by Herman gives some idea as to how the oxygen acts upon humus. He brought 28 volumes of wood that had commenced to rot under a bell-jar which contained 262 volumes of air. The wood remained under the globe for 10 days at a temperature of 27 degrees (Centigrade) after which time the volumes of air remained the same but the air contained less oxygen and more Carbonic Acid. The component parts of the air under this experiment may be exhibited as follows ;—

Before the experiment.		*After the experiment.*	
Nitrogen	207 volumes.	Nitrogen	194 volumes.
Carbonic acid ..	*Nil.*	Carbonic acid ..	40 „
Oxygen	55 „	Oxygen	28 „
	262 „		262 „

The chief results of the absorption of oxygen by the soil is the disintegration of mineral fragments, the decay of organic matter, and the supply of this element for respiration of the under-ground parts of the plant. The absorptive power of the soil may be increased by deep and frequent ploughing as well as by the addition of such materials as clay and organic matter which possess the quality of absorbing gases in a high degree.

13. The ammonia of the atmosphere is absorbed in the same way as oxygen and nitrogen, viz., by the surface attraction of the particles of soil. The ammonia absorbed by attraction is soon converted into Nitric acid by oxydation, and probably ammonia enters also into other chemical combinations and remains as ammonia in complex combinations (silicates). Considering the fact that the atmosphere contains but a small quantity of ammonia, the absorption of this element by the soil cannot be great. Carbonic acid behaves similarly to ammonia in the process of absorption. The air of the soil contains much more Carbonic acid than the atmosphere, the absorption of this gas is very great in clay soil owing to its capacity to absorb Carbonic acid. It is even possible that in a sandy soil, which has been newly manured with organic matter, the air of the soil should possess so great an amount of Carbonic acid that it may be

partly lost by diffusion into the atmosphere. For this reason light and frequent manuring with organic stuffs is especially adapted for sandy soils, whereas a clay soil, which possesses the power of absorbing a great amount of Carbonic acid may, without much risk, receive a heavy manuring. 1,000 volumes of atmospheric air contain 4 volumes of Carbonic acid. Boussingault and Lenis found that in newly-manured soil, after rain, the air contains as much as 9 per cent. of Carbonic acid.

14. Of far greater importance than the absorption of Carbonic acid is the absorption of water gas from the atmosphere. Atmospheric air always contains a certain amount of watery vapours which are attracted and absorbed more or less by solid substances, of which such as possess this quality in a high degree are said to possess a great hygroscopic power. Porous substances absorb a great amount of watery vapour. The hygroscopic power of the soil is considerable, clay absorbs 6 per cent. and humus, in form of peat, as much as 24 per cent. of its weight, in watery vapour. The more clay and humus a soil contains the greater is the absorption. It was found that a sandy soil, containing much organic matter, absorbed 70 per cent. of its weight in water, but after being ignited only 0·12 per cent. This illustrates the importance of organic matter in the soil especially in hot climates. A soil having much organic matter may, when properly tilled, in many instances, receive all the water required for the production of crops by air irrigation, that is to say, the atmospheric air circulating freely in the soil can supply all the water needed by the plants. When we remember that it has been found in Europe that plants often exhale, from their leaves, up to seven times as much water as they receive by rain, *so that about* 80 *per cent. of this water must have been absorbed from the atmosphere*, it must be admitted that the absorption of watery vapour by the soil is a power of nature deserving the greatest attention. The hygroscopic power of the soil, depends not only on the nature of its chemical constituents but, in a great degree on its mechanical condition; the soil can only then absorb moisture, when the air is allowed to circulate in it; the deeper the earth is broken up, and the more it is pulverized, the more freely will the air be able to circulate and the greater will be the absorption. Clay absorbs more moisture than sand, the particles of this soil being much more fine and numerous and each forming, so to speak, the centre of a watery vapour zone. The more moist the atmosphere is, the more moisture will be absorbed, and to this circumstance must be attributed the fact that islands, and places situated near the sea, frequently produce the most luxurious crops, even with little or no rain-fall. The lower the temperature the more moisture can be absorbed, and therefore, in hot climates the soil will absorb a larger quantity of moisture during the night, than in the day. Many soils cannot absorb any moisture during the day when the atmosphere is very dry and the soil contains little organic matter.

15. But the great change in temperature during day and night, observable, generally in hot climates, is most favorable to absorption; since, by the sinking of the temperature of the soil during the night, the watery vapour enveloping the particles of soil is condensed to liquid water, the formation of dew takes place, which penetrates the earth, and the soil is thereby enabled to absorb and condense watery vapour continually, so that although the attraction of watery vapour in a hot climate is less than in a cold one, the total amount of absorption, may be much greater in the former than in the latter.

16. Another important improvement effected by deep tillage is the increase of the capacity of the soil to hold liquid water. This capacity depends entirely on the porosity of the soil, that is, on the number of the capillary tubes or spaces the soil contains. As shown before, every soil, even when its particles are divided to the utmost, possesses spaces between those particles. These interstices determine the capillarity of the soil. They are of various dimensions, some being so small as to be able to hold water between them which are called capillary spaces of the soil. The larger ones have no capillary qualities and are under ordinary circumstances filled with air; the more capillary interstices a soil contains, the more water can it hold. One cubic foot of soil containing much rough sand possesses much fewer capillary interstices than a cubic foot of pure clay soil. The interstices of the latter are all capillary and such a soil can hold a greater amount of water, a quantity that may be beneficial or

injurious according to circumstances; on the whole, it would be more beneficial in a dry climate than in a wet one, where great moisture, caused by heavy rain-fall, very often proves a serious impediment to the production of plants. The occupation of all interstices by water, prevents the air from circulating in the soil, and the great amount of heat that becomes latent by the evaporation of the water makes the soil cold, a term used and well understood by practical Agriculturists.

17. The reduction of the heat of the soil, so undesirable in cold and humid climates, is a desideratum to the Cultivator in a warmer region. For this reason a clay soil possessing a great amount of organic matter, in order to create larger spaces for circulation of the air and to facilitate tillage, is the best adapted for a warm climate, by taking up the greatest amount of rain-water falling, generally in long intervals, and by allowing it only gradually to evaporate, thus keeps the soil to a certain degree, moist and cool. Of all soils, clay possesses the qualities which under every circumstance admit of most improvement by tillage. In hot climates, the rain falling with great force to the ground closes the surface of clay soil more or less, thus preventing the admittance of air which is the most essential factor in vegetable life. The clay, with its fine capillary tubes, displaying a great tendency to attract the water allows that fluid only slowly to pass into the soil, so that, when a rather heavy shower of rain falls, the water collects on the surface and converts the very fine particles of soil into a viscid paste covering the whole surface with a dense sheet impervious to water and which after becoming dry forms a crust that precludes the admittance of air. The chief cause of the formation of the crust is the evaporation of the water. It is well known that the height to which a liquid can rise in a capillary tube depends on the diameter of the tube and the chemical composition of the liquid, but, the fact that the temperature of the liquid and of the tube, is a principal agent in this process, is perhaps not so well understood. Wolf, who made minute investigations in this direction, found that the higher the temperature of the liquid or of the capillary tubes is, the less will be the height to which the liquid can rise. This is proved to be the case in Indian soils, where the salt rises to the surface of the land especially in the cold season after the heavy rains, that have reduced the temperature of the soil are over, and very little after the rains in the hot season. Generally pure water rises higher in the capillary tubes than a solution of salt; a concentrated solution can only rise to a considerable height in very narrow capillary tubes, and at a low temperature. It is evident that the clay soil whose interstices, owing to its fine particles, represent very narrow capillary tubes, is best qualified for the passage of the salt, from the subsoil to the surface. When after the rain in the cold season rapid evaporation takes place the minute capillary tubes, between the fine particles of the clay, possess so much attraction as to allow the solution of salt to rise to the surface from a considerable depth. There is no doubt that a soil saturated with water, possessing no drainage, promotes the rise of salt, because, much more evaporation taking place a larger amount of salt is conveyed to the surface, and then, the large amount of water in the soil being less saturated with salt on account of its abundance, is capable, as shown above, of rising to a great height. The force of the falling rain may produce a similar effect by beating down the soil and thereby reducing the size of the capillary tubes. A soil possessing more than a certain percentage of soluble salt in its upper surface is unfit for the production of the higher species of plants. It has been found by the artificial culture of plants in water, that the concentration of the salt solution should not be more than 0·5 per cent., though the water in the soil may probably contain a higher percentage of salt without proving injurious to the plant. As the minute capillary spaces are the vehicle by which the salt is conveyed to the surface, it is evident, from the foregoing consideration, that by reducing the number and enlarging the size of these spaces, only a small proportion of salt, if any, would be able to reach the surface. We have it in our power to effect this, by deep and frequent tillage, and, the addition of such matter as will reduce the capillarity of the soil, by enlarging the interstices to such a degree as to exhibit very little adhesion to the salt solution and thus render it incapable of rising. Drainage, is another means of counteracting the rise of salt to the surface by preventing the too great accumulation of water in the soil. By tillage the spaces of the soil become greater rendering the soil loose, so that many of

them losing their capillary power entirely, are rendered unable to conduct the salt to any height. The deeper the tillage and the more open the soil is kept, the more will this end be effected. It is true the dissolved salt will, if the subsoil be impervious remain immediately below the strata operated on by the plough but this may be let off by drains cut at certain depths. A soil constantly kept open will not only prevent the rise of the dissolved salt but to a great degree also that of pure water so that such a soil will keep the moisture longer than one whose capillary spaces are small. The crust, formed after rain should therefore be broken up as soon as the condition of the soil will permit it, in order that the capillary water-level may be kept lower and the admittance of atmospheric air be facilitated. It must be admitted that the capillary water evaporates into the larger interstices filled with air and is apt to be diffused to some extent in the circulating atmospheric air, especially when this is very dry.

18. The injurious effect produced by dry parching winds may be easily neutralized especially when blowing always from the same direction by planting some rows of trees or a good hedge on the side from whence the wind proceeds; and this will not only preserve the soil from becoming too dry but will also increase its capacity for absorbing moisture from the air. The benefit to be derived from deep ploughing will be especially manifest with regard to the falling rain. In climates subject to drought it is of the utmost importance to utilize every drop of water that falls from the clouds. Sandy soils (if the grains are not very fine), are sufficiently porous to admit of the passage of the rain-water into them. The finer the grains are, the more will the passage of water be impeded so that if the showers of rain are heavy, most of the water will run off from the surface. It is often to be observed that after a heavy shower of rain of perhaps $1\frac{1}{2}$ inch, a soil of this kind which should be saturated to a depth of about 6-7 inches has become wet only to a depth of 2-3 inches, the texture of the soil having become so close as to admit only about one-third of the falling rain the other two-thirds having run off and been utterly lost. This may be observed even in fields whose surface is nearly level. A section taken from such a soil after rain in the dry season will exhibit its upper layer to the depth of some inches as excessively wet and the layer below completely dry, both which conditions impede the growth of plants.

19. As soon however as the soil is properly tilled to a great depth so as to have wider spaces between its particles, the falling rain following its gravity will pass freely into the soil and extending down to a great depth will administer moisture with a greater degree of uniformity, and thus avoid excessive humidity. As a soil of this description is very apt to close again, and can only be effectually worked under certain conditions, the greatest attention is required in order to keep it in a state favorable for that purpose. A great amount of organic matter will however tend to remove all difficulties, and to render the soil so loose as to admit a large quantity of water, the free entrance of air and spreading of the roots of the plant will thus be facilitated and the soil be in a condition to be worked almost at any season. By deep ploughing, the roots of the plants will be encouraged to penetrate deeper into the ground, thus coming in contact with a much greater amount of plant food and a more regular supply of water resulting in the production of a more abundant crop. It would not be too much to assert that in many places, if the subsoil is not much inferior to the surface soil, one deep ploughing or subsoil ploughing every year, perhaps only every second year, with frequent stirring up of the upper soil and adequate manuring in the meantime would produce a double and perhaps even a three-fold yield of crop. When the roots are prevented from striking down into the subsoil, the plants will suffer from every change of weather and temperature, their roots not meeting with either a sufficient amount of plant food or water in such a limited space. Many crops cannot attain maturity on account of suffering from the bad effects of shallow tillage, for the evaporation of water from the plants being greater during the day than what the soil can store up the preceding night, the tissues of the plants become contracted to such a degree as to be rendered unfit to perform their functions of imbibing water again, so that the plants wither and die. Other plants again will commence flowering when scarcely half grown, the little moisture at the disposal of the plants under shallow tillage not sufficing for the formation of new organs or the completion of their growth.

Great dryness, is favorable to flowering and the production of fruit, but here the material for the formation of the seed is not prepared and the plants must succumb before attaining this stage of development.

20. A soil exhibiting a hard close impervious pan will hold less water than it will hold after it has been pulverized; but when made very loose many of the interstices will become so wide as not to be able to exercise any degree of capillary attraction.

21. With rough sand however, the case is different, its grains when lying loose together exhibit large spaces possessing little capillary force, but which becomes greater on the sand becoming more compact, so that the capacity of the same soil may vary more than 10 per cent. The capacity of agricultural soil to hold water varies from 20 to 100 per cent. of the weight of the soil; the former estimate referring to a sandy soil, and the latter to a clay soil which is very rich in organic matter.

22. Of course the capacity of a sandy soil to hold water depends chiefly on the largeness of its grains. Nearly pure but very fine sand may hold as much as 30 per cent. of its weight in water. A soil having its capillary tubes filled with water for some length of time can only produce aquatic plants such as grow in marshes.

23. Most plants, especially those of the higher type, will thrive only in a soil alternately saturated and dry, whilst other species can accommodate themselves to any circumstances. Some plants that have vegetated only under dry cultivation may nevertheless in the course of time gradually change their character altogether and become aquatic plants and *vice versâ*. Of all plants rice is the most capable of bearing a saturation of the soil for a long period and so with meadow herbs and grasses; yet these also, especially the higher varieties, will thrive best in a soil which is sometimes saturated.

24. There can be no doubt but that every species of plants and even each variety possesses certain peculiarities, as regards the amount of water in the soil conducive to its growth, which vary according to climate and soil. In this view the soil will only then yield the most abundant crop when this speciality of the plant is satisfied. The soil after being saturated with water loses a portion of it more or less rapidly according to the degree in which the water adheres to the soil. The evaporation is very rapid during the first few days, when a sandy soil possessing little organic matter may lose as much as half of its water. The more organic matter and the more clay the soil contains the more slowly will the water evaporate, so that such a soil contains for a long time after saturation has taken place as much as $\frac{1}{3}$-$\frac{1}{2}$ of the amount it held at first; whereas a sandy soil, poor in humus, will retain only $\frac{1}{8}$-$\frac{1}{10}$ of its water under similar circumstances.

25. The relation between the capacity of the soil to hold water and its vegetative power, depends very much on the quality of the soil. One of a sandy or loamy character, possessing much organic matter, may hold as much as 80-90 per cent. of water and may be more favorable to vegetation than a clay soil holding only 60-70 per cent., since the former being more loose encourages the evaporation of water as well as the circulation of atmospheric air. Loose soil may hold 100 per cent. water. In a soil containing a greater amount of organic matter, certain species of plants may grow as long as it contains not less than 10 per cent. of the amount the soil can hold, the absorption of the atmospheric moisture replacing the consumption. The limits between which the water in the soil may vary, without being injurious to vegetation by either too great dampness, or dryness, depends on the nature of the soil.

26. Loose sandy soil possessing $\frac{1}{2}$-$\frac{3}{4}$ of the water it can hold, appears best suited for most plants, whereas clay soil, unless possessing much organic matter, will be injurious to the growth of most plants if it contains for a long period as much as half the water it is capable of holding. There may be cases where the soil contains a small percentage of water and is even unable to absorb a considerable amount of moisture from the atmosphere and yet the plants growing on it will be found to thrive wonderfully well. In these instances the water needed is supplied from the under-ground water-level. It may be observed that water cannot rise higher than three feet by capillary

attraction. In sandy soils it seldom rises higher than one foot, so that when the subsoil water-level lies lower, the water can only rise in the form of vapour. Water is converted into vapour at every temperature. If the subsoil contains water and the upper soil is dry, the water gas rises through the capillary tubes to the upper soil, but if the temperature of the upper soil is lower than that of the subsoil, the water gas becomes condensed to liquid water in the form of dew. As the temperature of the upper soil generally sinks during the night below that of the subsoil, a considerable amount of water may rise to the surface soil and be condensed there, especially when the subsoil is open and the water-level does not lie too deep. It has been found that in a glass tube measuring five feet in length and two inches in diameter which was filled with sand, the water rose by capillary attraction to the height of 7½ inches. The upper part of the tube was exposed to direct insolation, yet after eight days' exposure the moisture in the upper layer was not changed. All the water evaporated from the surface was here replaced by the watery vapour rising from the subsoil through the capillary spaces, which has become condensed in the surface soil to liquid water.

27. The foregoing cursory exposition of some of the physical properties of the soil, will, it is hoped, serve to prove the important share which the physics of the soil claim in reference to the cultivation and production of plants, a science worthy to hold a place by the side of Agricultural Chemistry, but which has, unfortunately, been utterly neglected in India, to the detriment of the Cultivator.

28. Again and again, have men of science pointed out the danger accruing from a disregard to the laws of nature, as influencing the physical condition of the soil, a neglect which is less felt in localities possessing a rich virgin soil and a favorable climate, but infinitely more in countries where vegetation depends in a great degree on the physical properties of the soil. It may often happen that the capacity of the soil to absorb moisture from the atmosphere is of itself sufficient to decide the question as to whether a crop can be grown on it or not, whether animal life can find the means of subsistence, or must be left to perish.

SYDAPET,
13*th October* 1877.

(Signed) K. SCHIFFMAYER,
Asst. Supt., Govt. Farms.

SOME MANURAL SUBSTANCES YET UNUTILIZED IN THIS COUNTRY.

1. In previous Reports, attention has been directed to the manural value of lime, saltpetre, salt, oil-cake, aquatic weeds, tank scourings, brick-kiln ashes, &c., substances, which are either altogether unused in our agriculture, or are used only to a very limited extent, and, most of which can be obtained in some quantity, and at reasonable prices, over the greater part of the Presidency. I would now invite attention to other fertilizing matters that, are equally neglected by our cultivators, and which, are all procurable in considerable quantities and, at little cost. These are ;—human excreta, the refuse matters of slaughter-yards, and, the remains of animals.

Human excreta wasted.

2. *Human Excreta.*—There is an enormous loss of fertilizing matters in this country in the total waste of the excreta of man. In the plains they are very seldom collected for use as manure. In large towns they are, of course, always collected and removed from human habitations but, in such cases they are simply buried in the ground in some convenient locality, not however in view to their future utilization. In the villages, and throughout the rural districts generally, these matters are not even collected, but left to waste away where deposited; the result of the practice is, that the waste land, in close proximity to the larger villages, is frequently in a very disgusting state.

Dr. Voelcker's opinion of the manural value of human excreta.

3. We have, unfortunately, in this country, no satisfactory data by which we can determine the exact manural value of human excreta ; but in Europe, during the past twenty years, such matters have received great attention from Chemists. In a paper, on the Agricultural value of Earth Closet Manure, published in the Journal of the Royal Agricultural Society of England, Dr. Voelcker, F.R.S, the Consulting Chemist of the Society, has discussed very fully the chemistry of human excreta. He says ;—

Composition of human excreta very variable.

"Their composition, I need hardly say, is subject to considerable variations ; and consequently all calculations based upon analyses of these matters are liable to considerable fluctuations. Speaking generally, solid human excreta, as they leave the body, contain about one-fourth of dry matter and three-fourths of water. The dry matter contains about 1½ per cent. of nitrogen and 1 per cent. of Phosphoric acid.

"According to Professor Way, human fæces, in a recent condition, are stated to contain in 100 parts ;—

Water	75·00
Organic matter *	22·13
Insoluble silicious matter	·37
Oxide of iron	·13
Lime	·43
Magnesia	·38
Phosphoric acid	1·07
Sulphuric acid	·06
Potash	·30
Soda	·08
Chloride of sodium	·05
	100·00

"If it were possible to dry fæces without loss in fertilizing matters, and without the addition of bulky materials, they would, in a dry state, be a very valuable manure, for in that state they would contain ;—

* Containing nitrogen 1·50, equal to ammonia 1·82.

Organic matter*	88·52
Insoluble silicious matter	1·48
Oxide of iron	·54
Lime	1·72
Magnesia	1·55
Phosphoric acid	4·27
Sulphuric acid	·24
Potash	1·19
Soda	·31
Chloride of sodium	·18
	100·00

High manural value of solid excreta.

"It appears from the preceding figures that, in a perfectly dry condition, two tons of solid human excreta are worth almost as much as one ton of Peruvian Guano; and it seems a great pity that a manure possessing such a fertilizing value should be wasted as at present it is in a great measure.

Urine.

"Still more valuable as a manure is human urine, for its principal constituent—urica—contains nearly 50 per cent. of nitrogen; and uric acid—an active constituent of urine—contains about 33 per cent. of nitrogen; and besides these nitrogenous organic matters, human urine contains a good deal of Phosphoric acid.

"Unfortunately urine enters very rapidly into decomposition, giving rise to foul-smelling gaseous products of decomposition, and to volatile carbonate of ammonia; and on keeping, loses much of its most valuable constituents. The collection and preservation of urine, in consequence, is attended with practical difficulties, which are greatly enhanced by the trouble and expense of getting rid of the large proportion of water which urine naturally contains. For these reasons, all attempts to collect urine and to obtain from it a solid manure by evaporation have hitherto proved failures in an economical point of view.

"Fresh urine contains, on an average, only 3 per cent. of solid matter, and, according to Professor Way's analysis consists of:—

Water	97·000
Organic matter‡	2·026
Insoluble silicious matter	·003
Oxide of iron	·002
Lime	·018
Magnesia	·014
Phosphoric acid	·040
Sulphuric acid	·014
Potash	·055
Chloride of potassium	·162
Chloride of sodium	·566
	100·000

"Notwithstanding this large proportion of water, the amount of solid matter in the urine voided in a day is just about one-third greater than the amount of dry matter in the daily solid evacuations.

Solid matter in excreta.

"It is not easy to calculate with great precision what is the total amount of fæces and urine which is produced by a mixed population of adults and children of both sexes; but it may be safely stated that the amount of dry matter in the solid and liquid excreta of a mixed population does not exceed 56 lbs., per head per annum, and that probably it is not more than 45 or 46 lbs. In some experiments which Professor Way made upon adults, he found that an individual voids in 24 hours about ¼ lb. of fæces and 3 lbs. of urine. Assuming the preceding analysis fairly to represent the composition of the solid and liquid excreta of man, and each person of a population to produce ¼ lb. of fæces and 3 lbs. of urine in 24 hours, we obtain in

	Per Annum.
4 oz. of fæces 1 oz. of dry matter, or in round numbers nearly	23 lbs.
And in 3 lbs. of urine 1½ oz. of dry matter or in round numbers nearly	34 „

"Thus the liquid excreta of man contain one-half more dry matter than the solid.

"On calculating the amount of ammonia which will be produced on the decomposition of the dry matter of the solid and liquid excrements of each person per annum, we obtain from the

* Containing nitrogen 6·00, equal to ammonia 7·28.

‡ Do. nitrogen ·58, equal to ammonia ·71.

	Ammonia.
23 lbs. of dry matter contained in the solid excreta	1·60 lbs.
34 lbs. of dry matter contained in the liquid excreta	8·12 „
or altogether ..	9·72 „

"In other words, five-sixths of the ammonia capable of being generated on the decomposition of human excreta is furnished by the urine. By a similar calculation I find that, according to the preceding data, each individual would furnish about 5½ lbs. of phosphates per annum. For simplicity's sake we may assume that each person of a population produces in the solid and liquid excreta 56 lbs. of dry matter per annum. These 56 lbs. produce in round numbers 10 lbs. of ammonia and 5½ lbs. of phosphates."

4. I offer no apology, for making such a lengthy extract from Dr. Voelcker's Report for, I believe it to contain the fullest and most valuable information available, on the agricultural value of the excreta of man; and, but few persons in this country are likely to have met with a copy of Dr. Voelcker's Report.

5. There must, of course, be a very wide difference between the manural value of the human excreta of this country and of that of Europe. In India, the food of the people is bulky and innutritious consisting chiefly of grain, animal food forming but an inconsiderable item.

6. The agricultural value of ordinary human excreta in this country, cannot but be low, from the known poverty of the food of the people. It is a well-ascertained fact that the quality of the food of man, or beast, determines the manural value of their excreta.

Human excreta bulky in this country.

7. The bulk of the solid excreta of man in India is said to be greater than in Europe; but it is improbable that it contains a larger quantity of solid substances. We may, I think, estimate that in this country the dry substances, in mixed excreta of man, will weigh, per head of the population, about 45 lbs. capable of yielding, on decomposition, say, 6 lbs. of ammonia and 3 lbs. of phosphates. Of course, these figures are but estimates, they are however based on the best information we possess.

8. From these figures, it would appear that the average value of the liquid and solid excreta of one person, of our mixed population of adults and children, is, as follows;—

	RS.	A.	P.
6 lbs. of ammonia at 6 Annas per lb.	2	4	0
3 lbs. of phosphates at 1 Anna per lb.	0	3	0
Other matters	0	1	6
Total value of excreta, per head, per annum ..	2	8	6

The values, put upon the fertilizing matters, are the prices which similar manural constituents sell for, in portable manures, in this Presidency.

Liquid excreta never collected.

9. No attempts have been made in this country to collect the liquid excreta of man hence, for all practical purposes, its value must be left out in our calculations. From the extracts given, it appears that human urine, in Europe, furnishes five-sixths of the ammonia generated on the decomposition of mixed excreta, and about three-fourths of the phosphates. We must therefore deduct from Rupees 2-8-6, the value of five-sixths of the ammonia and three-fourths of the phosphates of the mixed excreta, which together, amounts to Rupees 2-0-3, leaving Annas 8, Pies 3 or, say, in round numbers, 8 Annas, per head, as the value, in one year, of the solid excreta of one person.

In rural localities no difficulty in utilizing excreta.

10. In rural districts, the utilization of solid human excreta is attended with but few difficulties, from the readiness with which it can be mixed with earth and village ashes and, made into a compost, in which form the stuff readily becomes deodorized. The Ryots object, and with good reason, to collect and remove to their land the excreta of town populations, for setting aside all considerations relating to caste prejudices, the work is an exceedingly unpleasant employment, while the intrinsic value of the stuff is frequently very low, from natural poverty or admixture with useless matters.

Town excreta must be prepared for use in agriculture.

11. If Municipal Corporations would get rid of the night-soil of their towns, by its utilization in agriculture as manure, they must convert it into a concentrated compound free from admixture with useless matters. There is no reason why poudrette should not be manufactured at, or, near many of our large towns. Manufactories for the preparation of poudrette have been established near many European towns, and the objectionable characteristics of such manufactories would not be greater in this country. Indeed, I think, that we have, in our dry atmosphere and high temperature, excepting during a small portion of the year, conditions highly favorable for the manufacture of poudrette, provided, always, that proper means are taken to check, or, keep back, the putrefactive processes which, in this country, operate so quickly.

12. There are many different ways by which solid excreta can be converted into a portable manure, for instance, by admixture with dried clay, burnt clay, ashes, caustic lime, sulphate of iron, gypsum, animal charcoal, &c. In China, it is worked up with clay into the form of bricks which, after being dried, are laid aside until required, when they are pulverized for application to the soil. Burnt clay is also used to some extent in Europe and also dried clay, the latter, is the material used in "Moule's Earth Closet System," but, clay, whether burnt or dried, must be used in considerable quantity in proportion to the bulk of the excreta, hence, the mixture will not bear the expense of distant carriage. Ashes, are well suited for admixture with excreta but, the large bulk of the compost is objectionable unless, the land to which it is to be applied is in close proximity. Caustic lime mixed with excreta prevents any unpleasant smell, and the mixture is an excellent manure, but, the lime should be added only when the excreta is in a fresh state or, the ammonia will be entirely driven off; there is certainly a loss of ammonia when the lime is added to the fresh excreta but, it is small. Where sulphate of iron can be obtained, at a price sufficiently low, it forms an excellent material for mixing with solid excreta. Powdered gypsum has been largely used in Europe for converting excreta into a portable manure. Animal charcoal, the refuse of sugar refineries is, perhaps, the best material that has ever been used for mixing with solid excreta, not only does it thoroughly deodorize the stuff but, it adds immensely to its manural value by the phosphates it contains. In some localities in this country, animal charcoal, the refuse of sugar refineries, can be purchased in considerable quantities, at a very reasonable cost; I recently had an offer of 600 tons at Rupees 35 per ton delivered in Madras, this charcoal, contained upwards of 50 per cent. of phosphate of lime; near the sugar refinery from which, the charcoal was offered, Rupees 25 per ton, would have been accepted, which is, a very low price, for a manure so rich in phosphates.

Animal charcoal a good material for admixture with excreta.

13. However, my present object is not to deal with that difficult problem, the utilization of the excreta of town populations; I desire only to point out that in rural districts on the plains, where there are no difficulties attending the utilization of this useful manure, it is entirely lost to agriculture.

High value of human excreta on the hills.

14. On the Nilgiris, where much land is in the hands of Europeans, human excreta is highly valued. The Coonoor Municipality in 1874-75 realized Rupees 2,866 for nightsoil and sweepings, and in the next year they realized Rupees 3,150. Four-fifths of the last mentioned sum, Rupees 2,520, represents the amount realized for the solid excreta of Coonoor in one year, which is about Annas 13½ per head of population. This is, of course, a much higher return than would be obtainable elsewhere in the Presidency, manure being so costly on the hills, owing to the great demand and, the difficulty of obtaining it; while, something must also be attributed to the excreta possessing a somewhat higher fertilizing value than that of more poorly fed populations. Thomas Stanes, Esq., who has used nightsoil largely on his estates at Coonoor, informs me that he finds it to be an excellent manure. In dealing with this manure Mr. Stanes' usual practice is to make it into a compost with other manure, and to keep it in a heap for a year, or so, when it is found to be sufficiently decomposed and deodorized for distribution over the land.

Method of using excreta.

15. At Ootacamund, the Municipality manufacture poudrette from a mixture of human excreta, sifted ashes, dried earth, blood and animal charcoal which, they sell readily, on the spot, at Rupees 7 per ton. The following shows the quantity of this poudrette made and, the amount realized for it, in each year, since the commencement of the manufacture ;—

Poudrette.

	TONS	RS.
1867-68	.	170
1868-69	..	162
1869-70	..	186
1870-71	68⅝	469
1871-72	213	724
1872-73	220	870
1873-74	260	1,307
1874-75	210	1,423
1875-76	432	2,861

Mr. Stanes informs me that he uses this manure, to some extent, on his coffee estates ; and that, he finds it a valuable manure, one cart-load producing as good an effect as four cart-loads of ordinary cattle manure.

16. *Slaughter-house Refuse.*—The refuse of slaughter-yards is, also, in this country, almost entirely wasted. It is difficult to obtain data, by which this loss to our agriculture can be ascertained. I possess statistics relating to Madras however which, will throw some light on the matter. In the City of Madras about 8,000 head of cattle, and, 220,000 sheep, are killed annually, in the Municipal slaughter-yards. The population, at the last Census, was 397,552 persons, of whom, probably, not more than 17,500 were total abstainers from animal food, leaving fully in round numbers 380,000 flesh-eaters.

17. The amount of butcher-meat consumed, per head of the population, is exceedingly small, due chiefly (as regards mutton) to the great poverty of the people. Under ordinary circumstances a pound of mutton, per day, suffices for the wants of a Hindu family of six persons ; but, small as this consumption is, *at the least* 12 *sheep would be required in a year*, for such a family. By far the largest number of the inhabitants of Madras who would gladly eat mutton, purchase it only on ceremonious and other special occasions, as a luxury.

Small consumption of meat due to poverty.

18. From experiments, I have made, I find that, a bullock of about 500 lbs. live weight, in a condition somewhat better than that of cattle when slaughtered for food in this country, will yield about 42 per cent. of saleable meat, the offal, thus being about 58 per cent. of the live weight; this is a much higher percentage than the offal forms of oxen in England, thus Mr. Laws, F.R.S., in his well-known paper on the composition of oxen and sheep, shows that the mean percentage of offal in 16 bullocks was only 38·85 per cent.

Offal of oxen

19. Assuming that, the average live-weight of a bullock, when slaughtered in Madras is 500 pounds, per head, and that, the offal weighs 58 per cent. of the live weight, the offal of one bullock will weigh 290 pounds, from this 290 pounds, we must deduct about 60 pounds, the weight of the portions of the offal, hide, hoof, head, tongue, &c., that are utilized, and there remains 230 pounds, of which 20 pounds is blood, as the weight of the refuse matters, from one bullock.

20. Blood is, of course, the most valuable portion of the refuse, it has long been known to be a most powerful manure, its composition resembles very closely that of flesh. Blood contains about 80 per cent. of water and 20 per cent. of solid matter, rich in nitrogen. Fully one-half of the ash of dry blood consists of common salt, the remainder of the ash is, chiefly phosphate of soda and phosphate of lime ; but as the ash constitutes only about 5 per cent. of the dry matter of blood, it does not possess much agricultural importance.

Blood valuable manure.

21. In England, fresh blood is occasionally used for mixing in a compost with ashes, generally at the rate of six gallons of blood to about one bushel of ashes ; the blood is purchased, at from 3 Pence to 4 Pence a gallon ; the compost after laying for a year in the heap, is thoroughly

Blood made into a compost.

deodorized and fit for use. On the Sydapet Experimental Farm, some of the blood and other refuse of the Commissariat slaughter-yards are utilized in the way just described, the manure after nine or ten months is found to be quite free from smell, and, in a dry powdery state.

Conversion of blood into manure.

22. The method usually followed in dealing with blood, is to dry it in a steam-cased vessel, in which, about 60 per cent. of the moisture is driven off. Professor Way, examined many samples of dry blood, the following are the results of three average samples :—

	Water.	Ammonia.
Sample 1	8·78	16·07
Do. 2	7·91	16·49
Do. 3	6·19	16·91

High manural value of dry blood.

It will be noticed that, the percentage of ammonia is very high, equal indeed to the amount found in ordinary Peruvian guano; blood is therefore of great value, as a manure for tea and sugar-cane plantations, for betel and plantain gardens, for cocoanut trees, &c.; sometimes blood is coagulated under the influence of heat, after which, it is broken down, mixed with charcoal gypsum, &c., and dried again, when, it is an excellent portable manure, and sells readily.

23. The fresh blood yielded by a bullock should be worth from 5 to 6 Annas. I fear that it is only as a *dry* manure, that blood could be utilized, in such a town as Madras, from the difficulty of transporting it to the land and the absence of local demand.

24. Estimating that the 20 pounds of liquid blood will yield 5 pounds of dried blood, containing 16 per cent. of ammonia, the blood of one bullock should be worth nearly 5 Annas, valuing the ammonia at 6 Annas per pound, but, of course, against this there is the cost of preparation.

Value of offal of one bullock.

25. The other refuse of the bullock, consisting of intestines, contents of stomachs, &c., will weigh about 210 pounds and, should be worth 7 Annas and 6 Pies, valuing it at 5 Rupees per ton, this 7 Annas and 6 Pies with 5 Annas for the dried blood, makes the total value of the refuse offal of one bullock Annas 12, Pies 6, or, in round numbers, Annas 12.

26. We thus find that the *whole* refuse of the cattle slaughtered at Madras should be worth, at the least, Rupees 6,000, of which Rupees 2,500, would be the value of the dried blood.

27. Excepting in the larger towns where Europeans and Eurasians reside, there are but few cattle slaughtered for food, and the loss of manural substances from this source cannot be otherwise than small, compared with that which results from the waste of the offal of sheep slaughtered for food.

Offal of sheep.

28. The offal of a sheep, killed when in the ordinary condition, weighs about 55 per cent. of the live-weight of the animal. In the Commissariat slaughter-yards at Sydapet, 409 sheep, which weighed 25,366 pounds live-weight, yielded 11,668 pounds of mutton, equal to 29 pounds of mutton per head, of 62 pounds live-weight, in this instance, the offal was about 54 per cent. of the live-weight. Mr. Laws, in his experiments, before referred to, found that, the skin, head, liver and other portions of the offal of a sheep, which are utilized, weighed about 14 per cent. of the live-weight, deducting this, we find that the refuse offal is, about 40 per cent. of the live-weight, of which the blood forms 4 per cent.

Sheep killed for food in Madras.

29. In the City of Madras, 220,000 sheep are killed in the year, estimating each of these to weigh 60 pounds live-weight and, that, the refuse offal is 40 per cent. of the live-weight, we find that, the weight of this refuse should amount to, in the year, 5,280,000 pounds, of which 528,000 pounds is blood. Valuing the refuse as before, the blood is worth 8,250 Rupees and, the other refuse Rupees 10,607-2-3 or, the entire refuse of the slaughter-yards in the year, assuming that none of the blood is utilized for food or other purposes, should be worth in round numbers twenty-five thousand rupees, less

the cost of drying the blood; and this refuse, should suffice to manure highly 2,000 acres of arable land every year.

30. The consumption of meat, in the City of Madras, would not, of course, be a fair standard, by which to gauge the consumption of meat over the whole Presidency, and thereby to determine the value of the refuse of animal slaughtered for food. I believe however that, the consumption of animal food in this Presidency, is very much greater than is usually supposed. If, we deduct from the population of the Presidency 1,095,445 Brahmins who, are the only total abstainers from flesh, excepting a small number of Hindu vegetarians, we find that, the flesh-eaters amount to about thirty millions. Even Brahmins, in some parts of India, eat flesh, as the following extract proves;—

* "Another peculiarity in the *âcharâ* of the Kâsmirian Brahmans is the universal consumption of meat. All eat mutton, goats' flesh, and fish. But they obey the usual restrictions of the Sâstras as to beef, pork, and the meat of other forbidden animals. They usually declare that the custom of eating meat is based on a dêsaguna, 'a virtue of the country,' and that they leave it off as soon as they descend into the plains. They also fully acknowledge the duty of *ahimsâ*, of preserving life, and themselves are by no means willing to kill anything. If told that their acts are not consistent with their professions, they answer that their abstaining from meat would not prevent the slaughter of animals, as the Mahommedans of the country would still require meat. There can be little doubt that the practice of eating meat has come down to the Kâsmirians from the most ancient times. It prevails to a much greater extent in Northern and Central India than is generally known. In the Punjab, the North-West Provinces, Rajputana, and in parts of Bengal all Siva Brahmins eat meat."

31. The Agricultural Statistics of this Presidency, do not show the number of sheep we possessed in any year, since the official year 1871-72, in that year our sheep stock was 6,745,000, while in the preceding Census, of 1869-70, the number of sheep was shown to be 6,196,000, we had, thus, an increase only amounting to 549,000 in the two years. Under the heading "sheep" goats are classed, and these, constitute at the least two-thirds of the number of animals classed as sheep. Assuming then, that, in the official year 1869-70, we possessed, in round numbers, four million goats and that one-third of these were she-goats in a breeding condition, they ought to have yielded, in the year, about two million kids. In the same way we may estimate that, one-third of the two millions one hundred and ninety-six thousand sheep, were breeding ewes, these, ought to have produced in the year, for each 100 at the least 75 lambs, or, 549,000 lambs. The increase of stock would thus be, say, in round numbers, two millions of kids and, half a million of lambs, total 2½ millions. Assuming that, in the following year the increase of stock was the same, and it was likely to be much greater from additional ewes and goats beginning to breed, the increase would represent altogether five millions which, with the stock on hand 1869-70, 6,196,000, should make the sheep-stock in 1871-72, 11,196,000 provided there were no deaths. Putting the death by disease, &c., at 10 per cent. per annum we should have had in 1871-72; 9,293,760 goats and sheep, whereas, we had only 6,745,000, showing a loss of two and a half millions which, I suppose *represents the number of animals that were slaughtered in the year for human food*, the refuse offal of which must represent a very considerable sum, if that of 220,000 sheep is worth as I have already shown Rupees 18,000.

32. *Carcases of diseased Animals.*—But besides the diminution of stock by slaughter there is annually an enormous loss by disease and from natural causes, the aggregate of which will represent an enormous quantity of manural matters that, under present arrangements, are almost entirely wasted.

Death of cattle by disease.

33. Few persons, are aware of the great loss of cattle, by death, during a year in this Presidency. From the Board of Revenue's Administration Report for 1873-74 and 1874-75, I learn that, the number of cattle reported to have died during these official years, was 507,303 and, 710,153; and during the past year, in many localities, 75 per cent. of the

* From a report by Dr. Buhler published in the Journal of the Bombay Branch of the Royal Asiatic Society for 1877, at page 23.

cattle are said to have died. The carcases of animals that have died are never utilized as manure, excepting, on coffee estates; of late a trade has sprung up in bones but, they are collected chiefly for export. It has already been shown that the refuse obtained, when a bullock is slaughtered for human food, is worth, as manure, under average circumstances, Annas 12; the remainder of the carcass, consisting of the flesh and bones, should be worth at the least Rupees 1-2-0, making the total manural value of a bullock of 500 pounds live-weight, Rupees 1-14-0, however, the cattle of the Presidency will not average, in live-weight, more than two-thirds of this weight, to arrive then, at the manural value of one such animal, we must deduct one-third from Rupees 1-14-0 which will leave Rupees 1-4-0 as, the manural value of the carcass of an ordinary cow, or bullock.

Carcases of diseased animals not utilized.

34. It is evident from the Custom House Returns of this Presidency showing the number of hides and skins exported annually that the death-rate of Farm Stock of all kinds, from slaughter, disease, and other causes, is vastly greater than is usually supposed, thus;—

Hides of Cattle and Skins of Sheep exported.

District from whose Ports the Hides and Skins were exported.	Hides.						Skins.					
	1870-71.	1871-72.	1872-73.	1873-74.	1874-75.	Total.	1870-71.	1871-72.	1872-73.	1873-74.	1874-75.	Total.
Madura	..	..	..	2	..	2	50	365	..	121	4,090	4,626
Malabar	37,664	30,587	52,909	79,983	347,921	549,064	11,392	17,153	12,678	14,294	19,915	75,432
Pakala, Nellore..	..	..	..	..	..	..	40	..	..	..	94	134
Madras	164,469	15,544	389,995	432,059	473,326	1,475,393	6,166,859	7,600,834	9,383,314	8,128,749	6,519,491	37,799,247
Cuddalore, South Arcot	..	100	233	..	..	333	520	13,211	1,483	4,940	2,000	22,154
Vizagapatam	158,690	104,253	267,622	173,393	157,034	860,992	141,703	111,495	216,689	160,162	142,100	772,149
Tanjore	..	190	200	50	35	475	1,328	1,700	1,080	2,482	4,495	11,085
Mangalore, South Canara	24,139	24,706	26,759	31,659	31,263	138,526	10,390	1,399	9,974	3,490	2,252	27,505
Godavery	19,851	23,556	96,385	88,165	43,524	271,481	319,637	349,901	309,385	304,907	266,804	1,550,634
Tinnevelly	3,847	3,908	5,089½	17,126	14,637½	44,608	54,906	84,573	67,959	72,547	87,067	367,052
Ganjam	97,570	48,019	120,660	91,178	93,811	451,238	16,657	9,217	17,552	17,369	24,649	85,444
Kistna	3,614	6,102	8,320	8,385	17,222	43,643	..	3,556	8,424	12,526	60,938	85,444
Total ..	509,844	256,965	968,172½	922,000	1,178,773½	3,835,755	6,723,482	8,193,404	10,028,538	8,721,587	7,133,895	40,800,906

Agricultural statistics inaccurate.

35. In this statement it is very probable that some hides and skins have been twice brought to account from their having been shipped to Madras and again reshipped there for export; but, this inaccuracy cannot influence much, the conclusions which must arise from fairly weighing the evidence the statement affords. It will be observed that in one year 1872-73, 10,028,538 sheep skins were exported whereas, the agricultural statistics show that the sheep-stock of this Presidency about that time, amounted only to about 6,745,000. As a sheep-skin can but represent the death of one sheep, it is evident that the agricultural statistics must, as regards sheep, be very inaccurate, for if the whole of the sheep-skins from the minor ports of the Eastern Coast had been shipped to Madras, which, of course, is highly improbable, they would not have added more than about half a million to those delivered in Madras by land. Of course, a number of hides and skins are taken to Madras from Mysore and Hyderabad by railway but, on account of the expensive carriage, it is not probable that this occurs to any great extent.

36. There is thus available to the Agriculturist a large quantity of valuable manural matter which he altogether neglects. I have, in the foregoing, shown the money-value of some of these refuse substances; it may be objected that the prices are higher than could generally be obtained; this, I admit to be true as regards the present time; but, if agriculture was practised as it should be, the prices I have set upon these refuse matters would be fully realized. However, I do not press the views expressed regarding this part of the subject. Whatever may be thought of the money values arrived at, there cannot be two opinions regarding the manural value of the substances.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms.

29*th September* 1877.

APPENDICES.

APPENDICES

TO

THE SYDAPET EXPERIMENTAL FARM REPORT.

RECEIPTS OF THE SYDAPET EXPERIMENTAL FARM DURING 1867-77.

Experimental Farm.

	Rs.	A.	P.	Rs.	A.	P.
Fruits, vegetables, &c.	618	8	0			
Fodder, &c.	115	14	11			
Rent, &c.	364	15	0			
Cattle	66	9	0			
Sheep	94	14	9			
Pigs	15	12	4			
Poultry, &c.	257	6	2			
Feeding grains	525	15	6			
Cotton	178	8	6			
Machines	106	7	6			
Indigo	85	6	2			
Seeds	147	14	2			
Sundries	181	3	5			
				2,759	7	5
Implement Workshops.						
Machines, &c.	915	13	0			
Labor materials, &c.	1,423	14	2			
				2,339	11	2
Total ...				5,099	2	7

VALUATION OF THE SYDAPET EXPERIMENTAL FARM ESTATE, BUILDINGS, &c., AND OF THE LIVE AND DEAD STOCK OF THE FARM, ON THE 31ST OF MARCH 1877.

	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Land—									
50 acres of land at Rupees 200 per acre	10,000	0	0						
130 do. at do. 140 do.	18,200	0	0						
100 do. at do. 70 do.	7,000	0	0						
Roshumbaukum Village-site	680	0	0						
				35,880	0	0			
Buildings—									
Superintendent's, Overseer's, Students' quarters with out-buildings.	10,000	0	0						
Granary; Barn Cart Sheep and Implement Sheds, and other Farm buildings.	9,800	0	0						
				19,800	0	0			
Wells (23) and channels	.....			3,600	0	0			
Fruit and other trees	.....			4,705	0	0			
							63,985	0	0
LIVE STOCK—									
Cattle	3,980	0	0						
Sheep	1,380	0	0						
Pigs	100	0	0						
Poultry	171	0	0						
				5,631	0	0			
DEAD STOCK—									
Seeds and Grains	494	9	0						
Manures	553	8	0						
Implements	6,617	13	0						
				7,665	14	0			
GROWING CROPS	.....			672	12	0			
							13,969	10	0
Total ...	.....			.....			77,954	10	0

APPENDICES

TO

THE AGRICULTURAL COLLEGE REPORT.

EXAMINATION REGULATIONS.

I. No student will be allowed to quit the Examination Room until the expiration of half an hour from the time fixed for the commencement of the examination, and a student arriving after the expiration of that half hour will not be admitted.

II. No student will be allowed to re-enter the Examination Room during the examination, after once quitting it, nor to leave the room without finally giving up his answer papers.

III. Any student detected in speaking to, or in any way communicating with, any other student, will be at once removed from the room, and the circumstances reported to the Superintendent, Government Farms.

IV. *No student will on any account be allowed to take into the Examination Room, books or papers of any kind.* Any one detected with such in his possession, or having recourse to any unfair practices, will be removed from the room and the occurrence reported to the Superintendent of Government Farms.

V. A student having completed his paper will rise from his seat and remain standing until the First Master takes his answer papers. Any student wishing to ask any question will pursue the same course but will on no account leave his place.

VI. Each page must be marked with the student's name, and his register number, and each page must be numbered in consecutive order. Any paper sent up without the student's name and number affixed will not be examined.

VII. Students will not be allowed to take any papers, except their question papers out of the Examination Room.

VIII. Students are forbidden to tear up papers or to throw papers on the floor. All "spoilt copies, &c.," should be left on the desk where the student has been writing.

EXAMINATION QUESTION PAPERS.

WINTER SESSION, 1876-77.

AGRICULTURE.

Examination—January 27th, 1877.

I. What are the uses of Farm Fences?

II. State what crops are growing in fields $\frac{B}{4}$ and $\frac{A}{14}$.

III. Why are the soils of the Farm unsuited for growing Tobacco?

IV. State some reasons why Indian Agriculture should be improved.

V. Explain in what way land under crop is benefited by being hoed.

VI. Mention the names of the different parts of an iron plough.

VII. State what work was performed yesterday in fields $\frac{B}{10}$ and $\frac{B}{8}$.

VIII. What kind of oil-cake is given to the sheep, and about what quantity is allowed for each full-grown sheep?

IX. State generally in what way a soil is benefited by deep tillage.

X. What crops are now growing in fields $\frac{A}{11}$ and $\frac{C}{16}$?

VETERINARY.

Examination—February 3rd, 1877.

I. How are living bodies distinguished from inanimate (or mineral) substances?

II. What organs are contained in the abdomen; and what kind of membrane lines the cavity?

III. Name the openings into the fauces.

IV. When the food is swallowed, where does it go, and what prevents it from going into the trachea (or wind-pipe)?

V. How are arteries to be distinguished from veins; arterial blood from venous blood, and what is the reason of the latter difference?

VI. In what respects does white fibrous tissue differ from yellow fibrous tissue?

VII. What is the microscopic structure of a voluntary muscle?

VIII. How many varieties of Epithelium are there, and what are they?

IX. What gives the blood its red colour?

X. Where the ends of two bones are brought together to form a free moving joint, how are they kept in opposition, and what provision is there to prevent friction?

CHEMISTRY.

Examination—February 10th, 1877.

I. What is a simple, and what a compound, body? Give examples. How many elementary bodies are there, and how are they classed?
II. What is meant by the *physical* and the *chemical* properties of a substance?
III. Give the meaning of the terms Cohesion and Chemical affinity.
IV. Define weight. What is the metric system of weights and measures based upon?
V. What is the unit of weight and of capacity in the metric system, and give the equivalents in English measure?
VI. Define Specific Gravity.
VII. You are required to shew how the specific gravity of a sample of milk is determined.

ARITHMETIC.

Examination—February 12th, 1877.

I. From the definition of a decimal fraction, shew that

$$\cdot 7256 = \frac{7256}{10000}.$$

II. Express as decimals $\frac{2^4}{10^7}$ and $\frac{3^5}{10^8}$, and the sum, and the product of the quantities.

III. Simplify:—

$$\frac{\cdot 1\times\cdot 1\times\cdot 1+\cdot 01\times\cdot 01\times\cdot 01}{\cdot 2\times\cdot 2\times\cdot 2+\cdot 02\times\cdot 02\times\cdot 02}.$$

IV. A man in mowing grass walks at the rate of ·4 miles an hour; it takes him 72 minutes to mow a grass plot of 1,056 square yards. How broad does he mow?

V. It is agreed that the rent of a farm shall consist of a fixed sum together with the value of a certain quantity of rice. When rice sells at 8 measures a rupee the rent is Rs. 250; and Rs. 280 when rice is 5 measures a Rupee. What will the rent be when rice sells at 6 measures a Rupee?

BOTANY.

Examination—February 17th, 1877.

I. Mention the parts of a flower and state which of these are essential and which non-essential.
II. Give the meaning of the terms acaulis, haulm, achlamydeous, monodelphous, culm, stipe, caudex and claw?
III. Describe a Phyllodium. How does it differ from the blade of a leaf?
IV. Give the names of the different kinds of underground stems, and mention examples.
V. Name the different parts of a fruit. For example, the pod of the common pea.
VI. Mention and describe briefly the different varieties of roots.
VII. Give a sketch of the following kinds of leaves:—
1. Entire.
2. Penninerved.
3. Curvinerved.
4. Palminerved.
VIII. How does a root differ from a stem?
IX. What are the various parts of a seed? For example, that of the Castor-oil plant.
X. What is the leaf arrangement to which the terms opposite decusate, whorled, geminate and fasciculate apply?

MENSURATION.

Examination—February 22nd, 1877.

I. Define a Straight line.
II. Define a Rhombus.
III. Define a Parallelogram.
IV. Define a Surface.
V. Define an Angle.
VI. Define a Trapezium.
VII. Construct a scale 8 feet equal to an inch.
VIII. On what principle is the Plummet level constructed?
IX. What is a Radius?
X. How would you find the breadth of a river without crossing it?

ZOOLOGY.

Examination—February 24th, 1877.

I. Classify the following animals:—

Monkey.	Mouse.	Tiger.	Tapir.	Narwhal.
Elephant.	Sperm Whale.	Bear.	Hippopotamus.	Manatee.
Camel.	Kangaroo.	Sheep.	Rhinoceros.	Mole.
Horse.	Rabbit.	Llama.	Sloth.	

II. Describe the stomach of a ruminant and the process of rumination.
III. How are quadrumana popularly divided?
IV. Show how the order *ungulata* is sub-divided.
V. Describe the teeth of a rodent.
VI. Describe the leg of a ruminant.
VII. How is the order Carnivora sub-divided?

AGRICULTURE.

Examination—March 3rd, 1877.

I. Name the mineral substances found in a fertile soil.
II. Mention the general properties of a clay loam.
III. Under what conditions would it be unwise to plough a soil deeply?
IV. What proportions of sand, clay, and lime are found in the following soils:—
A sandy loam.
A marly soil.
V. How are soils formed from rocks?
VI. What are the characteristics of an alluvial soil?
VII. What was done with the flax crop grown on the Experimental Farm after it was removed from the field, and with what object?
VIII. How would you improve a sandy soil that parted too readily with moisture?
IX. Whence is the Potash in a soil derived?
X. What would be the character of a soil formed by the disintegration of a quartz rock?

ARITHMETIC.

Examination—March 6th, 1877.

I. Divide 30 by 3·14159 to three places of decimals.
II. Convert the following fractions into decimals:—

$$\frac{1}{7},\ \frac{6}{7},\ \frac{79}{99999},\ \frac{79}{99900},\ \frac{23}{333}\ \&\ \frac{4111}{33300}.$$

Explain why the above fractions cannot be expressed as finite decimals. .

III. A country plough can plough a field in 5 days, an English plough can do the same work in three days; how long will it take them to do the work together?

IV. In the Centigrade Thermometer the freezing point is zero and the boiling point is 100°; in Fahrenheit's the freezing point is 32° and the boiling point is 212°; what degree C corresponds to 68° F.?

V. If the produce of a certain cereal crop be 20 times the seed, how many loads can be obtained from an ollock of seed after 5 crops have been raised?

8 Ollocks = One Measure.
8 Measures = One Markal.
42 Markals = One Load.

VI. When engaged in working the water-lift which waters the Carolina paddy, the bullocks walk at a uniform pace of 3 miles per hour round a circle whose circumference is 60 feet. Every circuit turns up 7 buckets, the contents of which are emptied in succession into the water course. Each bucket measures 1 ft. 5 inches long, 10 inches broad and 7½ inches deep. Find how much water is raised in a day of 8 working hours.

VETERINARY.

Examination—March 10th, 1877.

I. Describe the greater or Systemic circulation, noting the peculiarity of the portal portion.
II. What is the object of the Pulmonary circulation?
III. What are the differences between air expired from the lungs, and that of the atmosphere?
IV. What membranes cover the lungs, thoracic cavity and heart-sac (pericardium), and what line the pericardium, thoracic cavity, trachea and bronchial tubes?
V. How is the venous blood brought into contact with the air taken into the lungs?
VI. Is the diaphragm an inspiratory or an expiratory muscle?
VII. What is the difference between a true and a false rib?
VIII. What is "Coughing," and what causes it?
IX. What substances are found in the Blood?
X. What are the four varieties of food, and of what Chemical elements do they consist?

CHEMISTRY.

Examination—March 17th, 1877.

I. Define Temperature. What essential difference is there between the temperature of a body and the quantity of heat it contains?

II. Show how to graduate a common Mercurial Thermometer. What are the scales used? Give the freezing and boiling points on each.

III. The average maximum temperature in Madras during the past month has been 87° 6′ F.; and the greatest cold experienced by the Arctic voyagers in the late expedition was 102° F. below freezing point. What numbers in the Centigrade Scale correspond to these degrees respectively?

IV. What is meant by Latent Heat? If a piece of ice be put in a saucepan on the fire and kept there, what are the effects on a thermometer placed in the saucepan?

V. What are the three ways in which heat can be transferred from one place to another? Give examples.

VI. Give the meaning of the following:—

Atom; Molecule; Crith; Equivalent; Molecular weight?

VII. Give two of the more useful processes for preparing Hydrogen, and explain the chemical changes which result by symbols.

VIII. What weight of Hydrogen will 77 Grammes of zinc liberate from dilute hydric sulphate?

IX. State the properties of Hydrogen, and quote and explain experiments shown to illustrate its lightness and its inflammability.

X. Why is a mixture of Hydrogen and air explosive?

BOTANY.

Examination—March 24th, 1877.

I. What is a pitcher? State the views as regards its formation.

II. What terms are used to signify the various arrangements in the bud of the floral and foliage leaves? and define them.

III. When are stems said to be

(*a.*) Ascending.
(*b.*) Prostrate.
(*c.*) Creeping.
(*d.*) Climbing.
(*e.*) Twining.

IV. Describe a leaf-bud.

V. Give the characters of the following kinds of inflorescence:—

Corymb.
Compound umbel.
Raceme.
Cone.
Catkin.

VI. What are the distinguishing characters of a tree, shrub and under-shrub?

MENSURATION.

Examination—April 4th, 1877.

I. How many cart-loads of gravel will be required for a carriage-drive 200 yards long and 16 feet wide, the gravel to be spread 4 inches in thickness? (A cart-load = ½ a cubic yard.)

II. Required the number of Casuarina trees to plant an acre, the trees to be planted 3 feet part in the rows and the rows to be 4 feet from each other.

III. Calculate the amount of earth in an embankment 300 feet long, 30 feet high, 50 feet wide at the bottom and 15 feet wide at the top.

IV. Show what area of land the earth in the embankment (see previous question) would cover, if removed and spread uniformly to a thickness of 7 inches.

V. Find the cubical contents of a teak beam 20 feet long, 12 inches thick, and 9 inches broad.

VI. Find the value of the teak beam (see previous question) at 80 Rupees per ton of 50 cubic feet.

VII. How many paving tiles, each 6 inches by 9 inches, would be required to pave a yard 28 feet in length by 19 feet wide?

VIII. Write down the number of square yards in a cawnie, in an acre, and in a ground.

IX. How could you continue the measurement of a straight line, when impeded by an object obstructing the sight.

X. How many squares of plastering are there in a room 15 feet long, 12 feet wide, and 10 feet high, deducting one door 6 feet by 5 feet and two windows 3 feet by 2 feet each?

AGRICULTURE.

Sessional Examination—March 26th, 1877.

I. State what you observed during the last cropping season, regarding the effects of deep tillage, on the Farm.

II. What information does a mechanical analysis of a soil afford?

III. What are the properties of a stiff clay, and what are the means by which such a soil could be improved?

IV. Describe briefly the principal varieties of soils found on the Farm, and indicate generally the portions of the Farm where each variety predominates.

V. If a country plough costs Rupees 3, and an English plough costs Rupees 18, explain in what way a ryot can be benefited by using an English plough.

VI. What advantages are secured by sowing seed by means of seed-drills?

VII. Give the general results of the Sorghum crop recently produced in field —— and of the Cholum crops recently produced in fields ——, ——, ——, and ——.

VIII. How are soils usually classified?

IX. What mineral matters do plants remove from the soil?

X. Name some serious defects in the agricultural practice of Southern India.

VETERINARY.

Sessional Examination—March 27th, 1877.

I. Why are animals warm?
II. What are the various tissues to be found in the leg of an animal?
III. What is the use of the arch of the vertebræ?
IV. What are tendons and ligaments, their uses, and of what tissues are they composed?
V. Which of the component parts of the blood are found in the serum?
VI. How do the bicuspid and tricuspid valves prevent the flow of the blood from the ventricles to the auricles?
VII. The capillaries which convey blood to the tissues being closed tubes, how do the tissues get their nutriment from the blood?
VIII. How is Expiration effected.
IX What is the Alimentary canal?
X. What is Saliva; what its composition and uses, and how does it get into the mouth?

CHEMISTRY.

Sessional Examination—March 28th, 1877.

I. State the number of milligrams contained in 7·5 cubic centimeters of water at 0° C.
II. Equal volumes of Benzol and Glycerin weigh 102 and 147 grams respectively, and the specific gravity of the Benzol is 0 850; what is the specific gravity of the Glycerin?
III. Describe the method of taking the specific gravity of a light substance like wood.
IV. Write a description of the process of distillation by means of the apparatus known as Liebig's Condenser.
V. How is cane-juice converted into the solid substance—brown sugar? What circumstances would quicken the process of conversion?
VI. State briefly the law of gaseous volumes. Is there any difference between the molecular volume of Chlorine (Cl) and of the vapour of Acetic acid ($C_2 H_4 O_2$)—the former a simple, and the latter a compound gas?
VII. What do you understand by quantivalence of an element? Illustrate your meaning in the following list of elementary substances:—

H; O; Cl; C; Zn.

VIII. What is the action of a stream of dry Hydrogen gas on heated Magnetic Oxide of Iron ($Fe_3 O_4$) placed in a suitable apparatus? Give reaction.
IX. Supposing 27 grams of pure water are completely decomposed by the voltaic current, what volume will the liberated gases—collected separately over each pole—occupy at 0° C. and 760 m. m. pressure? What will their respective weights be?
X. Describe the process for preparing Oxygen gas with Potassium chlorate. Show and explain decomposition
XI. How is oxygen distinguished from other colourless gases? What is combustion?
XII. Read the following formulæ, and state what the figures and symbols in each case express:

$H_2 = 2$; $O_2 = 32$; $Cl = 71$; $H_2 O = 18$; $H Cl = 36·5$; $H_2 SO_4 = 98$.

BOTANY.

Sessional Examination—March 29th, 1877.

I. Give some important points of difference between plants and animals.
II. What does Economic botany relate to?
III. Describe characters, having reference to leaves and flowers only, which distinguish *Dicotyledons* from *Monocotyledons*.
IV. Describe shapes assumed by stems.
V. Give examples of tubers.
VI. Describe the two varieties of bulbs, viz., tunicated and scaly, and give examples of each.
VII. State what you know about a runner, an offset, and a sucker.
VIII. Mention examples of hollow stems.
IX. Mention and explain terms used to describe condition of the surface of stems
X. To what description of stems would you apply the terms fruticose and suffruticose?

ZOOLOGY.

Sessional Examination—April 4th, 1877.

I. Describe briefly the order Cheiroptera, and fully the structure of the wing of a bat.
II. Explain the terms Perissodactyla, Artiodactyla, Omnivora, Ruminantia, and give instances of animals under each of these heads.
III. State the various grounds on which the class Mammals is separated from that of Birds.
IV. Classify the following birds: Owl, crow, kite, pigeon, and peacock.
V. Describe the sternum, coracoid bone, scapula, and furculum of birds.
VI. Name the birds that are useful to the agriculturist, and state how they are useful to him.
VII. In what respect do the Dugong and Manatee differ from Whales.
VIII. Name all those Mammals that prove troublesome to the farmer.
IX. Name all those Mammals which are useful to man.

ATTENDANCE MARKS REGULATIONS.

Marks for attendance will be awarded as follows :—

	Marks.
On the Farm, early morning	3
Lecture, morning	2
Class-room, afternoon	2
Lecture do.	2
Field-class in the evening	2

Students absent without leave will be debited with marks at the rate shown above. Students, who do not appear at the Reading-room and get their names marked on the roll, before 6-30 in the morning, will be considered absent without leave, and students who are not present at the roll-call at the time fixed for each Lecture, class-room gathering, Field-class, &c., will be considered absent without leave. Students absent with leave will have no marks deducted. At the end of the session one-third of the net marks obtained by each student will be added to the total marks he obtains at the examinations. Leave for absence from an examination will not be granted except, on the production of a medical certificate; and when ordinary leave is granted it must clearly be understood that the leave does not apply to absence from examinations.

EXAMINATIONS, AND FULL MARKS.

			Marks.
		Ordinary Examinations.	
January	27th	(*a*). Agriculture	100
February	3rd	(*a*). Veterinary	100
„	10th	(*a*). Chemistry	100
„	12th	(*c*). Arithmetic	100
„	17th	(*a*). Botany	100
„	22nd	(*c*). Mensuration	100
„	24th	(*a*). Zoology	100
March	3rd	(*a*). Agriculture	100
„	5th	(*c*). Arithmetic	100
„	10th	(*a*). Veterinary	100
„	15th	(*c*). Mensuration	100
„	17th	(*a*). Chemistry	100
„	24th	(*a*). Botany	100
		Sessional Examinations.	
March	26th	(*b*). Agriculture Paper	200
„	26th	Do. Practical	100
„	27th	(*b*). Veterinary	200
„	28th	(*b*). Chemistry	200
„	29th	(*b*). Botany	200
April	4th	(*b*). Zoology	200
		Total ...	2,400

Time allowed—Ordinary Examinations—1 hour.
Sessional do. 3 hours.

APPENDICES

TO

THE CAROLINA PADDY REPORT.

METEOROLOGY OF SOUTH CAROLINA FROM THE YEAR 1868 TO 1870.

Year and Month.	South Carolina.																							
	Aiken.				Gowdysville.				Fort Mill.				Camden.				Bluffton.				Holland's Store.			
	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.
January 1868	75	22	34·5	2·00	65	12	38·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	68	32	50·3	5·41	..	..	..	..	..	..	..	..	68	22	47·7	2·82	..	..	..	..	..	..	..	..
Do. 1870	77	23	49·1	2·86	66	18	47·1	4·45	..	..	..	..	..	..	..	..	78	32	56·1	3·70	66	20	47·2	5·70
February 1868	65	25	34·6	3·34	64	19	38·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	70	25	49·0	6·73	69	22	50·1	..	..	..	..	..	69	19	47·0	5·45	..	..	..	..	..	..	..	..
Do. 1870	70	15	46·6	2·77	68	16	44·1	4·45	..	..	..	..	..	..	..	..	76	32	53·8	2·20	68	16	46·0	6·98
March 1868	84	32	55·8	3·51	82	22	52·9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	75	25	53·3	2·58	77	20	53·3	2·58	..	..	..	..	74	16	51·5	2·36	..	..	..	..	..	..	..	..
Do. 1870	73	26	52·5	6·05	69	23	48·7	7·58	68	26	47·1	..	..	..	..	..	74	38	57·7	5·30	78	25	51·5	10·10
April 1868	87	39	57·0	9·34	83	35	58·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	84	34	62·9	5·05	88	28	59·2	2·21	..	..	..	..	84	34	62·4	1·69	..	..	..	..	..	..	..	..
Do. 1870	91	34	64·8	..	90	38	62·9	3·82	84	38	62·2	..	..	..	..	..	91	40	63·4	2·30	93	38	65·2	2·10
May 1868	87	56	69·8	6·42	89	50	68·8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	91	48	67·8	1·19	89	50	68·0	3·57	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	91	60	72·9	1·92	90	53	76·3	3·65	90	52	70·3	..	..	..	..	..	92	60	74·3	2·70	..	..	..	..
June 1868	92	63	74·1	2·46	89	62	74·7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	94	64	77·4	3·72	91	65	77·8	4·25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	92	61	75·7	8·31	..	62	75·6	3·18	94	60	75·1	..	..	..	..	..	95	71	79·8	9·30	..	..	..	..
July 1868	99	71	79·4	..	97	72	82·1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	101	68	81·4	5·56	99	69	82·7	2·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	96	70	82·7	2·36	94	74	82·3	5·74	..	..	..	..	..	..	..	..	98	75	84·8	2·00	..	..	..	..
August 1868	90	65	76·2	6·40	90	65	77·6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869 ..	96	61	79·0	5·11	99	66	83·4	2·40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	96	62	79·8	6·00																				
Do. 1870	93	70	78·8	3·22	94	68	81·3	1·75	..	..	..	..	..	..	..	..	93	75	83·0	6·10	..	..	..	..
September 1868	87	50	73·1	4·04	89	50	72·8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869 ..	87	51	71·2	1·79	90	51	73·3	1·77	90	50	71·2	..	..	..	..	..	..	..	..	..	..	..	..	..
	88	54	71·0	3·00																				
Do. 1870	87	63	..	0·83	86	63	73·8	2·05	..	..	..	..	..	..	..	..	90	70	77·8	5·20	..	..	..	..

METEOROLOGY OF SOUTH CAROLINA FROM THE YEAR 1868 TO 1870—(*Continued*).

Year and Month.	South Carolina.																							
	Aiken.				Gowdysville.				Fort Mill.				Camden.				Bluffton.				Holland's Store.			
	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.
October 1868	79	42	..	3·57	82	37	62·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	76	36	59·9	1·37	78	30	59·2	2·37	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	80	49	65·3	4·40	..	..	..	..	..	..	..	..	..	..	..	..	86	56	71·6	8·40	..	..	..	..
November 1868	79	33	..	..	78	30	51·2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	71	30	47·4	2·76	67	27	47·5	3·85	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	78	29	52·7	2·11	70	27	52·1	2·50	..	..	..	..	..	..	..	..	86	39	60·9	4·20	..	..	..	..
December 1868	69	12	42·4	2·67	65	4	38·3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	67	30	47·1	4·58	68	22	43·6	6·97	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	75	10	43·7	1·53	69	7	41·6	5·10	..	..	..	..	..	..	..	..	68	18	48·4	5·20	..	..	..	..

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875.

Months.	Barometer reduced to 32°.					Thermometer in Shade.								Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain.		Wind.		Ozone.	Clear Sky.
	Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.				Amount Collected.	No. of Rainy Days.	Mean Daily Velocity.	General Direction.		
Madras District.	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
January	30·122	29·844	·278	·120	29·977	87·2	61·4	25·8	84·6	67·3	17·3	74·9	68·7	73	134·1	61·6	·15	2	142	N. E. by E.	47	66
February	30·100	29·819	·281	·124	29·951	91·3	64·0	27·3	86·6	68·9	17·7	77·0	70·9	74	133·5	63·9	2·19	2	128	N. E. by E.	44	70
March	30·060	29·743	·317	·133	29·898	95·1	65·1	30·0	89·4	71·7	17·7	79·8	73·4	74	135·4	67·4	1·18	2	159	S. E. by E.	43	80
April	29·986	29·637	·350	·133	29·817	101·1	72·8	28·4	92·9	77·3	15·6	83·9	77·0	74	137·2	74·4	·95	1	198	S. E.	42	71
May	29·909	29·458	·451	·123	29·730	105·2	74·4	30·8	97·4	80·1	17·3	86 0	77·3	68	138·3	78·3	2·50	2	233	S. by E.	44	64
June	29·830	29·538	·292	·121	29·693	104·0	74·7	29·3	97·7	80·4	17·3	86·3	75·7	62	133·8	78·6	2·08	9	223	S. S. W.	39	34
July	29·846	29·565	·281	·122	29·717	102·4	74·3	28·1	96·1	78·6	17·5	84·7	74·3	64	132·7	76·6	4·35	14	211	S. W.	41	27
August	29·892	29·605	·287	·124	29·747	99·2	73·5	25·7	93·9	77·3	16·6	83·4	75·4	70	134·2	75·4	4·43	14	179	S. W. by S.	44	36
September	29·911	29·599	·312	·135	29·763	99·0	72·4	26·6	92·8	76·8	16 0	82·8	75·7	72	136 1	74·7	4·78	13	160	...	38	38
October	29·984	29·654	·330	·119	29·633	96·3	70 5	25·8	87·9	75·0	12·9	77·8	75·2	81	131 9	72 3	12·61	16	119	N. W. by N.	41	37
November	30·059	29·772	·287	·113	29·932	90·1	67·5	22·5	84·8	73·0	11·8	77·7	73·2	81	131·3	69·8	18·08	17	174	N. N. E.	52	37
December	30·099	29·823	·275	·114	29·976	87·1	63·9	23 1	83·7	70·4	13·3	75·8	70·7	78	133·1	66·1	4·92	8	169	N. E.	52	52
Kurnool District.																						
January	29·182	28·864	·317	·150	29·009	94·3	55·8	38·5	89·7	61·6	28·1	74·6	62·6	52	137·0	57·4	·36	1	107	S. E. by E.	25	82
February	29·148	28·785	·364	·158	28·949	100·6	61·3	39·3	95·2	66·9	28·7	80·2	64·4	43	145·5	62·9	..	...	111	S. E. by S.	20	85
March	29·047	28·697	·350	·159	28·856	107·6	64·3	43·3	101·8	72·2	29·6	86·0	66·0	35	152·3	68·2	·33	1	120	S. E. by S.	8	82
April	29·038	28·686	·352	·171	28·853	110·2	71·6	38·7	105·6	78·7	26·9	90·7	69·8	36	158·0	85·5	·35	2	165	S. by W.	36	69
May	28·978	28·618	·360	·163	29·048	109·7	72 6	37·2	103·6	78·6	25·0	88·9	72·5	47	153·7	77·3	3·44	7	234	S. W.	23	48
June	28·910	28·618	·292	·139	28·779	103·4	71·5	31·9	96·1	76·0	20·3	84·1	73·3	61	142·2	74·9	3·82	10	369	W. S. W.	27	27
July	28 929	28·646	·283	·125	28·800	97·8	71·1	26·7	91·3	73·7	17·6	80·6	72·5	68	136 3	72·5	6·64	13	340	W. by S.	28	19
August	28·991	28·682	·310	·141	28·829	97·4	70·5	26 9	91·8	73·7	18·0	81·2	72·3	66	139·6	72·3	3·32	9	313	W. by S.	33	28
September	29·006	28·681	·325	·149	28·852	94·6	69·5	25·1	89·5	73·0	16·5	79·6	72·9	74	140·6	71·4	8·65	13	259	West.	33	26
October	29·090	28·762	·327	·139	28·803	96·0	64 3	31·8	90·2	71·7	18·6	79·3	71·5	69	140·0	68·7	3·62	7	135	...	37	42
November	29·163	28·851	·312	·145	29 022	93·0	59·0	34·0	88 8	66 3	22·5	76·4	66·9	61	137·3	62·8	·84	3	132	E. S. E.	33	59
December	29·212	28·899	·313	·151	29·057	92·2	56·6	35·6	88·1	63 3	24·8	74·5	64·7	59	135·8	59 6	·69	3	112	E. by S.	29	69
Masulipatam (Kistna District).																						
January	30·148	29·845	·304	·126	29·987	86·7	61·1	25·6	82·7	65·4	17·4	73·8	67·9	74	142·5	59 5	1·67	2	155	E. N. E.	53	66
February	30·123	29·791	·332	·129	29 949	92·2	63·1	29·1	86·0	68·0	17·9	76·8	70·2	72	145·5	62·3	·84	2	76	E. S. E.	42	68
March	30·067	29·734	·333	·131	29 886	97·5	66·8	30·7	90·3	72·3	18·0	80·3	73 8	74	146·7	67·1	3·06	2	175	.	56	65
April	29·988	29·599	·389	·133	29 798	104·9	72·5	32·5	94·8	77·8	16·7	84·6	77·4	73	150·0	73·7	·25	1	...	South.	49	58
May	29 878	29·461	·417	·134	29·695	110·3	74·5	35·8	98·5	81·1	17·4	87·5	78·6	68	152·5	78·3	1·19	6	...	S. S. W.	48	48
June	29·782	29·486	·296	·122	29·635	104·7	74·1	30·6	96·1	80 6	15·5	86·4	77·2	67	144 7	78·5	4·39	13	..	S. W. by W.	44	30
July	29·792	29·503	·290	·116	29·653	100·4	73·9	26·5	91·7	77·6	14·1	83·1	76·0	73	137·2	75·3	6·59	20	21	W. by S.	50	26

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875—(*Continued*).

Months.	Barometer reduced to 32°. Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Thermometer in Shade. Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.	Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain. Amount Collected.	No. of Rainy Days.	Wind. Mean Daily Velocity.	General Direction.	Ozone.	Clear Sky.
Masulipatam (Kistna District)—(Continued).	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
August	29·854	29·555	·299	·121	29·694	98·0	73·3	24·7	91·7	77·9	13·8	83·4	76·6	74	142·5	74·7	5·90	15	21	W. by S.	47	32
September	29·885	29·538	·347	·130	29·723	95·5	73·8	21·6	89·7	77·3	12·5	82·2	76·8	79	144·2	74·2	7·34	16	20	West.	48	36
October	29·988	29·614	·374	·115	29·718	93·8	70·8	23·0	87·0	75·7	11·2	80·4	75·4	79	139·8	72·5	11·05	15	14	N. by E.	48	40
November	30·087	29·769	·318	·116	29·952	87·7	66·9	20·8	83·9	71·4	12·5	77·3	71·8	77	142·6	67·4	3·87	5	20	N. E.	51	54
December	30·139	29·855	·284	·124	29·996	85·1	61·2	23·8	82·5	67·5	15·0	74·7	69·2	76	141·3	62·9	·26	2	30	N. E. by E.	49	61
Coimbatore District.																						
January	28·731	28·454	·277	·148	28·581	91·1	57·1	34·0	86·1	62·9	23·2	73·3	63·0	57	135·0	58·2	·33	3	77	E. N. E.	42	65
February	28·715	28·613	·302	·161	28·561	95·1	60·0	35·1	90·2	65·9	24·4	76·8	65·0	54	138·5	57·6	·47	3	82	E. N. E.	38	67
March	28·692	28·392	·300	·162	28·531	100·1	60·8	39·3	95·4	68·9	26·5	80·7	67·9	53	144·4	64·8	·58	2	87	E. S. E.	37	66
April	28·638	28·289	·345	·162	28·475	100·3	68·9	31·4	96·4	72·8	23·6	82·5	71·8	60	142·9	69·6	2·28	6	96	..	44	47
May	28·587	28·279	·289	·128	28·441	98·3	68·6	29·7	92·4	72·8	19·6	80·2	72·2	69	135·8	70·0	2·43	9	144	S. S. W.	45	36
June	28·543	28·283	·260	·96	28·428	95·1	68·0	27·1	87·9	71·4	16·6	77·4	70·2	71	130·1	69·5	2·55	11	211	S. W.	50	20
July	28·544	28·332	·212	·91	28·449	91·1	67·8	23·3	86·8	70·3	16·5	76·1	69·7	74	131·1	68·4	1·35	9	223	S. W.	50	22
August	28·581	28·327	·254	·113	28·460	93·2	68·3	22·9	88·3	70·6	17·7	76·9	70·3	61	136·2	68·6	·78	5	196	S. W.	44	26
September	28·595	28·345	·251	·129	28·470	91·9	67·7	24·2	88·3	70·3	18·0	77·1	70·1	73	139·0	68·3	1·54	7	188	S. W.	41	29
October	28·645	28·350	·295	·140	28·489	93·1	66·4	26·7	87·6	70·1	17·5	76·3	70·7	77	138·5	68·5	6·10	12	96	...	36	24
November	28·700	28·396	·304	·140	28·561	90·5	63·4	27·1	85·1	68·7	16·3	75·4	68·7	73	134·6	66·3	5·18	10	76	E. N. E.	37	28
December	28·737	28·445	·291	·142	28·592	88·8	57·6	31·1	84·9	65·1	19·7	73·6	65·7	66	134·5	61·5	·47	3	81	E. N. E.	38	46
Madura District.																						
January	29·622	29·346	·276	·138	29·478	91·5	61·7	29·7	87·3	67·0	20·2	76·3	68·5	68	135·4	60·7	1·10	3	131	N. E. by E.	57	58
February	29·592	29·319	·272	·145	29·460	95·0	63·6	31·4	90·5	68·3	22·2	78·4	69·6	65	137·4	62·1	1·21	3	121	...	73	58
March	29·578	29·254	·324	·158	29·419	100·5	64·3	36·2	94·1	71·4	24·5	82·1	71·6	60	141·8	65·9	2·95	3	92	E. S. E.	31	62
April	29·493	29·201	·291	·147	29·358	101·8	69·9	31·9	97·9	75·2	22·7	84·4	74·6	63	141·8	70·6	3·57	4	78	S. E. by S.	47	51
May	29·447	29·149	·298	·146	29·304	103·9	71·3	32·6	98·8	76·2	22·6	84·8	74·6	63	140·1	71·0	3·24	4	81	...	37	49
June	29·408	29·140	·268	·121	29·284	103·1	73·0	30·1	96·9	76·5	20·4	84·2	73·7	61	138·6	72·6	2·90	3	119	West	32	40
July	29·429	29·184	·245	·116	29·306	101·5	72·0	29·6	97·2	75·9	21·2	83·6	72·9	60	139·4	72·1	2·22	3	106	W. N. W.	49	42
August	29·453	29·178	·275	·124	29·320	101·7	70·7	31·0	96·6	75·4	21·2	83·3	73·5	63	140·3	71·8	4·92	7	77	W. by N.	54	44
September	29·458	29·200	·258	·145	29·333	100·0	71·6	28·5	95·3	74·6	20·6	82·4	73·5	66	141·5	70·8	3·55	8	74	W. N. W.	64	45
October	29·517	29·222	·296	·131	29·453	97·7	70·2	27·5	91·4	73·2	18·1	80·0	73·7	75	137·5	70·2	9·03	13	59	N. W. by N.	72	42
November	29·575	29·275	·300	·133	29·444	93·3	68·7	24·6	87·3	72·2	15·1	78·3	72·9	78	134·3	68·6	6·68	9	102	E. N. E.	68	42
December	29·603	29·340	·263	·127	29·482	89·9	64·4	25·6	86·0	69·5	16·5	76·5	70·9	76	135·2	64·6	2·04	5	116	E. N. E.	65	53

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875—(*Continued*).

Months.	Barometer reduced to 32°.					Thermometer in Shade.								Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain.		Wind.		Ozone.	Clear Sky.
	Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.				Amount Collected.	No. of Rainy Days.	Mean Daily Velocity.	General Direction.		
	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
Bellary District.																						
January	28·653	28·338	·315	·148	28·482	94·5	55·0	39·3	88·9	60 3	28·6	72·8	60·1	48	135·3	56·2	·36	2	77	E. S. E.	41	79
February	28·623	28·310	·292	·152	28·453	98·1	59·9	39·6	94·5	65·8	28·7	78·6	63 2	43	141·6	62·7	·04	1	98	S. S. W.	38	82
March	28·571	28·266	·325	·154	28·404	106·2	65·1	41·0	101 0	71·2	29·9	84·6	64·5	33	151·7	67·7	·34	1	118	S. by E.	34	79
April	28·515	28·191	·324	·157	28·342	108·2	71·0	37·3	104·1	76·8	27·3	88·6	68·5	37	157·0	74·3	·65	3	136	S. by W.	36	66
May	28·460	28·140	·319	·152	28·300	107·0	69·8	37·2	101·3	76·4	24·9	86·5	70·8	48	154·6	74·9	2·93	8	208	W. N. W.	43	45
June	28·396	28·104	·292	·121	28·268	104·0	70 8	33·2	94·7	75·0	19·7	82·4	71·3	59	146 6	73·6	2·47	8	237	W. S. W.	46	25
July	28·404	28·155	·249	·109	28·290	97·2	70·9	26 3	91·0	74·0	17·0	80·0	70·3	63	141·5	73·0	1·47	8	283	West.	46	18
August	28·445	28·171	·274	·125	28·312	97·7	69·7	28·1	92·7	73 0	19·6	80·6	70·2	61	145·5	71·9	1·68	8	275	W. by N.	42	30
September	28·475	28·176	·299	·137	28 330	95·4	68·9	26·6	90 0	72·4	17·6	79 1	70·5	67	143·4	63·4	4·08	13	228	W. N. W.	44	23
October	28·551	28 216	·335	·135	28·381	94 9	64 9	29·9	89·4	70·7	18 0	78·1	71·1	65	139·9	67·9	5·51	12	110	...	44	32
November	28·620	28·335	·285	·136	28·477	92 5	58·4	34·1	87·9	65·4	22·5	75·1	65·2	60	137·6	61·4	1·16	4	76	E. N. E.	47	49
December	28 655	28 359	·296	·141	28 503	91·4	54·3	37·1	87·3	61·8	25·4	72·8	62·4	57	132·0	57·3	·11	2	75	E. by S.	51	62
Trichinopoly District.																						
January	29·851	29·546	·305	·148	29·574	91·0	60·8	28·3	86·9	66·5	20·4	75·3	67·7	68	136·2	61·0	1·06	3	153	N. E. by E.	33	65
February	29·817	29·522	·295	·148	29·672	95·3	63·5	31 9	90·8	68·7	22·0	78 3	67·7	65	138 5	63·0	2·64	4	130	E. N. E.	47	69
March	29·787	29·466	·321	·165	29·647	101·1	64·9	36·2	96·4	71·9	24·5	82·5	71·5	59	142 2	66·4	·07	1	121	S. E. by E.	32	76
April	29·716	29·362	·354	·157	29·552	104·2	72·2	32·0	98·9	77 3	21·6	86·0	74·9	60	143·0	74·0	1·50	3	144	...	...	45
May	29 688	29·332	·355	·146	29·515	106·4	74·0	32·3	100·6	78·5	22·1	87 3	75·1	57	140·3	76·0	2·39	5	198	W. by S.	...	45
June	29·603	29·299	·304	·122	29 465	102·1	74·8	27·3	97·2	78·3	18·9	85·4	73·6	57	135·0	76·7	1·79	6	356	West.	17	20
July	29·603	29·337	·265	·122	29·479	99·6	73·7	26·0	96·1	77·5	18·6	84·6	73·0	57	134·8	75·8	2·16	4	360	W. by N.	23	20
August	29·644	29 336	·308	·138	29·499	99 9	72·5	27·5	95·4	76·5	19·0	83·8	73·2	61	135·6	74·8	3·88	9	264	West.	26	21
September	29·655	29·350	·305	·153	29·512	98·5	72·1	26·5	94·0	75·8	18·2	82·9	73·3	64	136 6	73·9	5 14	9	243	W. by N.	28	21
October	29·703	29·397	·306	·142	29·546	95·5	69·5	26·1	89·5	73·5	16 0	79·9	73·7	75	134·5	71·3	6·05	15	125	N. W. by W.	31	22
November	29·767	29·480	·287	...	29·637	90·1	68·6	21·5	85·9	72·3	13·6	77 5	72·6	79	133·3	68·9	5 69	11	146	N. E. by N.	34	27
December	29·815	29·540	·275	·131	29·682	89·4	63·0	26·3	85·1	69 2	15·8	75·6	69·8	75	133·1	65·2	1·97	5	158	N. E. by N.	41	47
Negapatam (Tanjore District).																						
January	30 096	29·828	·268	·121	29·959	84·9	64·1	20 8	82·5	70·3	12·1	76·4	71·1	78	144·9	66·9	2·16	4	148	N. E.	84	64
February	30·078	29·804	·274	·127	29·941	86 9	66·2	20·7	84 4	72·1	12·3	78·1	72 2	75	143·6	68·8	2 74	3	110	East.	77	67
March	30·050	29·754	·296	·136	29 900	94 3	67·9	26·4	88·3	75·6	12·7	81·4	75·1	75	146·0	71·2	1·16	1	107	S. E. by E.	63	78
April	29·984	29·667	·318	·136	29·824	100·0	72·7	27·3	92·8	78·5	14·3	84·3	78·0	76	147·4	75 0	2·39	3	135	S. E. by S.	59	73
May	29·918	29·574	·344	·128	29·759	103 6	71·9	31·6	96 5	78·6	17·9	85 0	77·6	72	146·0	75·9	1·74	3	190	...	61	67
June	29·856	29·574	·282	·123	29·728	102·7	74 5	28·1	97·8	78·8	19·0	85·3	76·3	67	144·4	75·9	1·13	4	207	S. W.	71	57
July	29·871	29·601	·271	·125	29·750	101·6	74·0	27·6	97 2	78·0	19·2	84·2	75·5	67	144·9	75·5	2·05	6	201	S. W.	67	56

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875—(*Continued*).

Months.	Barometer reduced to 32°.					Thermometer in Shade.								Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain.		Wind.		Ozone.	Clear Sky.
	Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.				Amount Collected.	No. of Rainy Days.	Mean Daily Velocity.	General Direction.		
Negapatam, (Tanjore District) —(Continued).	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
August	29·736	29·635	·279	·129	29·776	99·2	74·1	25·1	94·7	77·3	17·4	83·1	76·0	72	144·3	74·6	3·69	7	158	S. W.	63	54
September	29·928	29·648	·279	·143	29·795	97·9	72·5	25·4	93·4	76·7	16·7	82·3	75·8	74	146·3	74·0	4·73	8	151	S. W.	64	52
October	29·990	29·672	·319	·132	29·824	95·8	71·8	24·0	89·4	75·5	13·8	80·7	75·7	80	142·1	73·3	7·36	15	112	S. W.	68	47
November	30·046	29·763	·283	·121	29·915	90·4	70·6	19·8	84·7	74·3	10·4	78·4	74·1	82	137·6	72·1	16·76	19	172	N. E. by N.	76	40
December	30·085	29·818	·266	·117	29·957	86·8	67·0	19·8	82·6	72·9	9·7	76·9	71·9	79	139·1	69·8	5·91	8	177	N. E.	73	50
Salem District.																						
January	29·205	28·906	·299	·155	29·040	91·3	58·3	33·0	87·2	64·7	22·4	75·2	66·1	62	144·1	57·3	·25	1	117	E. N. E.	57	80
February	29·177	28·870	·307	·162	29·017	97·9	60·9	37·0	93·0	66·8	26·2	78·8	67·9	57	145·8	61·4	·48	2	133	E. by N.	51	82
March	29·145	28·815	·330	·171	28·975	103·4	61·3	42·1	98·3	70·7	27·6	83·3	69·6	51	147·5	66·1	·50	2	128	S. E. by E.	40	82
April	29·086	28·734	·352	·172	28·912	104·2	69·9	34·3	100·0	75·4	24·6	85·7	73·0	56	157·4	71·5	3·13	7	108	S. S. E.	38	66
May	29·217	28·688	·329	·146	28·871	103·3	69·6	31·7	97·8	75·7	22·1	84·7	74·1	62	140·9	72·4	6·01	8	111	S. W.	37	56
June	28·980	28·681	·299	·124	28·854	100·0	71·0	28·9	94·7	74·4	20·3	82·4	73·3	66	136·9	71·6	2·36	9	129	S. W.	39	36
July	28·993	28·727	·266	·126	28·875	98·7	71·1	27·6	93·0	73·0	20·0	80·7	72·6	69	135·7	70·2	4·20	13	130	S. W. by W.	40	33
August	29·039	28·746	·293	·139	28·893	97·0	70·4	26·6	92·0	72·8	19·3	80·4	73·1	71	139·4	70·2	5·16	16	98	W. S. W.	37	36
September	29·039	28·753	·286	·150	28·903	95·6	69·8	25·8	85·5	72·4	19·0	80·4	73·1	72	141·9	69·3	6·36	12	96	W. S. W.	34	40
October	29·092	28·787	·305	·144	29·111	93·4	66·7	26·7	89·0	71·6	17·4	78·5	73·1	78	133·6	69·0	9·25	15	59	N. W. by W.	34	38
November	29·149	28·870	·279	·134	29·014	92·0	62·8	29·3	87·1	69·3	17·8	76·8	70·7	74	141·2	65·9	2·89	10	83	N. E. by E.	44	51
December	29·191	28·895	·295	·142	29·047	90·2	58·6	31·6	86·5	65·9	20·7	75·1	67·6	68	141·4	60·6	·78	4	100	E. N. E.	49	65

MADAGASCAR PADDY.

PROCEEDINGS of the BOARD OF REVENUE, dated 4th October 1877, No. 4,633.

Read the following letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of Government Farms, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Sydapet, 21st September 1877, No. 820:—

WHEN preparing my report on the Carolina paddy experiments of this Presidency, I had occasion to search through many American publications for information regarding the early history of that paddy, and while so engaged I frequently met with statements to the effect that the Carolina paddy is the descendant of paddy imported into America from Madagascar.

2. It being a matter of some importance, in connection with the improvement of the rice of this country, to determine whether Madagascar now possesses any varieties of paddy of a class so high as that from which the Carolina paddy must have originated, I obtained, through the kindness of the Reverend Mr. Organe of Madras, the address of the Reverend Mr. Toy, a Missionary residing in Madagascar, and I asked that gentleman to be good enough to procure and forward to Madras samples of the different varieties of paddy grown in Madagascar.

3. The samples of paddy have just reached me; they represent five varieties, but only one appears to merit special attention; it is that of the paddy known in Madagascar as Rojofotsy. I enclose a sample of this paddy and a sample of its rice. It will be noted that the grain is very large. For comparison I also enclose samples of Carolina paddy and rice.

4. On comparing the two varieties of paddy, it will be observed that the grain of the Madagascar variety is considerably the largest. I find that, while 846 grains of the former weigh one ounce, it requires 990 grains of the latter to make up the same weight. The Carolina paddy is a very good sample and quite as large in the grain as when first imported into this country. Had the Rojofotsy paddy been as well cultivated as the Carolina paddy, the grain would have looked much better; only a portion of it appears to have been properly matured. Both varieties of paddy contain an admixture of paddy that yields a red rice. It can scarcely be said that this proves their common origin, for it frequently happens that red rice is mixed with white rice. The red rice which is found in America amongst Carolina rice may have been as readily introduced into that country in Indian seeds as in Madagascar seed.

5. On comparing the rice of the two varieties of paddy, it will be observed that the Carolina rice is smaller, though whiter, plumper, and more starchey than that of the Rojofotsy paddy. From a small experiment I made, I found that, while the Carolina paddy yielded 79·79 per cent. of rice, the Rojofotsy yielded only 76·46 per cent. by weight. The lesser yield of rice from the Madagascar paddy was due, I think, to many of the grains being imperfect, for, as I have already noticed, the perfectly formed grain is heavier than the grain of Carolina paddy of equal quality. The two samples are not, of course, of equal commercial value for export purposes, but for local consumption I would consider the Madagascar rice is quite equal to the Carolina rice.

6. I possess no information regarding the habit of the plant that produces the Rojofotsy paddy. It is, of course, quite possible that the crop may be unsuited for introduction into this country from being long in reaching maturity, or for other reasons. It seems, however, desirable that further inquiries should be instituted.

7. It seems not improbable but that the Rojofotsy paddy may be the variety from which the Carolina paddy was descended. The color of its husk is certainly not that rich golden color which now is so characteristic of the Carolina paddy seed, but the color of the husk may have become gradually darker in America. However, after growing a crop of the Rojofotsy I will be better able to form an opinion on this matter.

8. If Madagascar cannot supply a variety of paddy suited for introduction into this country in view to its cultivation, that Island may perhaps be able to afford a supply of paddy which, at the present crisis, might prove highly acceptable as food in this country.